DOCUMENT RESUME

ED 075 317 SO 005 661

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TITLE The Effects on Achievement of Using the Forced Inferential Response Mode in an Intermediate Grade Population-Geography Unit.
INSTITUTION Georgia Univ., Athens. Geography Curriculum Project.
PUB DATE 72
NOTE 140p.; Ed.D. Dissertation; University of Georgia

EDRS PRICE MF-$0.65 HC-$6.58
DESCRIPTORS Academic Achievement; Achievement Tests; Curriculum Evaluation; *Curriculum Research; Doctoral Theses; *Geography Instruction; Human Geography; Instructional Materials; Intermediate Grades; *Learning Theories; *Population Education; Population Trends; *Response Mode; Social Studies Units; Teaching Techniques
IDENTIFIERS *Geography Curriculum Project; Inferential Response Mode

ABSTRACT

This study describes and evaluates an intermediate grade self-instructional unit in population geography organized according to the Forced Inferential Response Mode (FIRM) method of presentation. This mode of presentation is compared with a conventional narrative mode supplemented with graphics. The study indicates no statistically significant difference in pupil achievement on the criterion post-test when both modes are compared. Six chapters comprise the study: 1) Background to the Study; 2) Review of the Literature; 3) Development of Materials Used in the Study; 4) Procedures and Methodologies; 5) Findings and Discussions of the Findings; and 6) Summary, Conclusions and Implications of Further Research. Ten appendices, including a bibliography, are included in the work. (FDI)

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# THE EFFECTS ON ACHIEVEMENT OF USING THE FORCED INFERENTIAL RESPONSE MODE IN AN INTERMEDIATE GRADE POPULATION-GEOGRAPHY UNIT

by

JOHN RAYMOND DALE

B.S., Central Connecticut State College, 1965
M.S., Central Connecticut State College, 1968

SP005661

A Dissertation Submitted to the Graduate Faculty
of the University of Georgia in Partial Fulfillment
of the
Requirements for the Degree

DOCTOR OF EDUCATION

ATHENS, GEORGIA

1972

GEOGRAPHY CURRICULUM PROJECT
UNIVERSITY OF GEORGIA / 107 DUDLEY HALL / ATHENS, GEORGIA 30601

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JOHN RAYMOND DALE

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ACKNOWLEDGMENT

I would sincerely like to thank my major professor, Dr. Marion J. Rice, for the encouragement and understanding he has given me during my two years at the University of Ceorgia.

I also gratefully acknowledge Dr. Warren Findley for the guidance and suggestions he gave to me while serving as my statistical advisor and chairman of my reading committee.

Appreciation is also expressed to the other members of my reading committee, Dr. Robert Saveland and Dr. Juanita Skelton, and members of my advisory committee, Dr. Don Hoy and Dr. Jonathon C. McLendon.

Special thanks are also extended to my wife for her tireless efforts as my typist and editor, and for the inspiration and motivation she instilled in me.

ACKNOWLEDGMENT OF PUBLIC SCHOOL COOPERATION

Appreciation is expressed to the following school personnel for making this study possible. A special word of appreciation is due to the students, without whose willing efforts the necessary data could not have been collected.

Clarke County School District
Dr. Frusanna Booth, Curriculum Director

Gaines School Elementary School
Mrs. Robbie J. Gregory, Grade 5

Barnett Shoals Road Elementary School
Mrs. Diana Pearson, Grade 5

East Athens Elementary School
Mrs. Miriam Clum, Grade 6
Mrs. Helen K. Penley, Grade 6
Mrs. Charlotte Moore, Grade 6

Pattie Hilsman Junior High School
Mrs. Sherry Malone, Grade 7
Mrs. Louise R. Jones, Grade 7

Oconee County School District
Dr. Clyde Maxwell, Curriculum Director

Oconee County Intermediate School
Mrs. Margarite Crenshaw, Grade 7

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# CHAPTER I

## BACKGROUND TO THE STUDY

This study is a description and evaluation of an intermediate grade self-instructional unit in population geography organized according to a method of presentation described as the Forced Inferential Response Mode (FIRM). This mode of presentation was compared with a conventional narrative mode supplemented with graphics. The content of the two treatments was identical.

The substantive content of population was chosen as the focus for knowledge development because there is an absence of population content in current social studies currricula. The FIRM method of presentation was utilized because it provided the student with an opportunity to learn population content through the exercise of map and graphic skills.

The study did not indicate any statistically significant difference in pupil achievement on the criterion posttest by treatment mode, FIRM or narrative. Nevertheless, the study makes a contribution to geography curriculum research by providing teachers and pupils with needed materials in population geography which also develop in a systematic sequence map and graphic skills.

## The Geography Curriculum Project

This study was undertaken as a part of the Geography Curriculum Project of the University of Georgia. In the structuring of materials to meet the goals and purposes of this Project, a number of background components were merged. In geography content, the study applied the concept of population dynamics in a systematic unit comparing the growth of population in the United States and Mexico. In learning theory, the unit attempted to operationalize the Forced Inferential Response Mode (FIRM). In graphic usage, the unit attempted to evaluate the comparative effectiveness of graphics as the primary source of population information and as a visual supplement to a narrative text. These elements were fused in the study to meet the objectives of the Project.

The Geography Curriculum Project was initiated as a result of a "critical review of evidence (which) indicates that the teaching of geography as a science in the elementary schools is not commensurate with its status as a scholarly discipline for the analysis, interpretation, and integration of phenomena within a spatial frame of reference (Rice, 1965, p. 127)." The initial purpose of the Geography Curriculum Project was to prepare and evaluate curriculum materials that were "systematically structured and conceptual in nature and organized according to the science of geography (Imperatore, 1970, p. 1)." The units developed have been for students in the elementary and middle grades. All of the units have been

specifically written to emphasize the organizing concepts of the discipline of geography. These units were designed to supplement rather than replace any existing social studies curriculum.

Beginning in 1970, a second dimension was added to the research of the Geography Curriculum Project--the systematic development of curriculum materials in accordance with some instructional or learning theory. This additional emphasis did not change the conceptual, structural emphasis of the geographic content. It added, however, a more vigorous research dimension to the evaluation.

The first Project curriculum evaluation that reflected this new emphasis was an attempt by Steinbrink (1970) to construct a conceptual unit on "Comparative Landscapes" according to his interpretation of Ausubel's advance organizers. The conceptual emphasis of the unit was reflected in the structure and content of "Comparative Landscapes." The application of Ausubel's learning theory was evidenced in the endeavor to write advance organizers and test their efficiency as pre-organizers in comparison with using the organizer as a summary, or post-organizer.

## Purposes of the Research

Three major questions were asked in this study--two experimental and one theoretical. The first question was a pragmatic question of classroom utility. Was the unit,

"Population Growth in the United States and Mexico," appropriate for use with middle grade students?

The answer to this question is of interest to geographers and demographers as well as to teachers because systematic instruction in population has not been part of the content of the social studies curriculum. A review of existing population education materials revealed a general paucity of population curriculum materials designed for middle grade use (See Chapter III). Of the materials that were available, there was a general orientation toward treating population changes as problems to be solved, rather than phenomena to be understood (See Appendix A).

In contrast to the population problem approach, the unit of this study, "Population Growth in the United States and Mexico," was designed to provide students with a background and understanding of the components of population change. The unit does not attempt to evaluate the psychological and ecological effects of population change.

The second question related to the comparative effectiveness of different modes of presentation. Was the Forced Inferential Response Mode, hereafter referred to as FIRM, more effective than a narrative mode supplemented with graphics for presenting a population geography unit to middle grade students? As the review of graphics research in Chapter II indicates, it is generally assumed that maps and graphics usage are important social studies skills. From the standpoint

of geography, map presentation is the most important visual tool, and was most important to this comparative population unit. Population has an areal distribution, which lends itself readily to map presentation, and a quantitative base which is subject to graphic presentation. A population unit, therefore, appeared to lend itself to presentation in the form of visuals only to be used in a self-instructional text. This text, as explained later in "Definition of Terms," was conceptualized as FIRM with the visuals constituting the data base.

The third, and perhaps most difficult question of the study, was the question of the relationship of FIRM to learning theory. As noted in the preceding section relating to the Geography Curriculum Project, the Project is attempting to use learning theory to construct classroom curriculum materials. An objective of Project research is concurrent evaluation of the appropriateness of the materials for school use and the evaluation of the application of learning theory to the construction of curriculum materials. Was FIRM, as conceptualized by the researcher, an alternate form of the S-R reinforcement model? A major part of the review of the literature in Chapter II is concerned with this third and theoretical question.

To provide a medium for evaluating the effectiveness of FIRM, the researcher developed parallel versions of the unit, "Population Growth in the United States and Mexico." One

version of the unit utilized the FIRM format of material organization (See Appendix H), and the second followed the more traditional structure of a written narrative supplemented with graphic illustrations (See Appendix I).

## Hypotheses

The parallel versions of the unit referred to in Question 2 provided the basis for testing the research and statistical hypotheses. The three research hypotheses tested in this experiment were:

1. Subjects using the Forced Inferential Response Mode treatment materials will score significantly higher on the researcher-constructed criterion posttest than the students that use the same content materials presented in the form of a written narrative when adjustments are made for initial differences in vocabulary, map reading, and graph reading skills.

2. Subjects using the Forced Inferential Response Mode treatment materials will score significantly higher on a standardized posttest of map reading skills than the students that use the same content materials presented in the form of a written narrative when adjustments are made for initial differences in map reading skills.

3. Subjects using the Forced Inferential Response Mode treatment materials will score significantly higher on a standardized posttest of graph reading skills than the students that use the same content materials presented in the form of a written narrative when adjustments are made for initial differences in graph reading skills.

These three research hypotheses were tested at the fifth, sixth, and seventh grade levels.

The three statistical hypotheses tested in this experiment were:

1. There will be no significant difference in scores on a researcher-constructed criterion posttest between the treatment groups when adjustments are made for initial differences in vocabulary, map reading, and graph reading skills.

2. There will be no significant difference in scores on a standardized posttest of map reading skills between the treatment groups when adjustments are made for initial differences in map reading skills.

3. There will be no significant difference in scores on a standardized posttest of graph reading skills between the treatment groups when adjustments are made for initial differences in graph reading skills.

These three statistical hypotheses were tested at the fifth, sixth, and seventh grade levels.

## Definition of Terms

The key term in this study is FIRM, an acronym for the Forced Inferential Response Mode, a self-instructional text which uses incomplete sentence stems to force a student to derive information from a data base in order to construct a series of sequential responses. When correctly completed, the stems and the responses compose a logical narrative which interprets information contained in the data base.

This brief description of FIRM shows its relationship to the usual tutorial text. A comparison of FIRM with a programmed text, however, shows that FIRM has a more complex data base in which there are many variables. For example, the key concept of variable population density of the pre-Columbian Indian population of North America is one of many

concepts and facts presented in the data base in Figure 1, page 3, Appendix H. In order to respond to the second stem on facing page 4, the student must be able to select the response "density" from the many variables presented graphically in the data base on page 3.

In contrast, programming normally provides more restrictive cues to the desired response. A simple illustration of this programmed text procedure is taken from the programmed text Evolution (Thomas, 1971, p. 3):

> . . .
>
> EVOLUTION is the word that means the slow change in living things over the years.
>
> . . .
>
> No matter what plants or animals you write down, they have all changed over the years. The change that has taken place is called E V O L __ __ __ __ __.
> (fill in blanks)

A comparison of the FIRM with the programmed format suggests that a FIRM response requires the student to use greater skills of perception, discrimination, and the application of previous knowledge. In the programmed format, it appears that the student is more likely required to apply the skill of direct association.

The key words in FIRM are forced, inferential, data base, logical narrative, and progressive complexity. These words are defined in more detail in this section. Other major terms in the study relate to population education and reinforcement.

Data Base: A body of data in which all responses that are to be associated with written stimuli are presented. In this application of FIRM, the data base was composed of various types of maps, charts, graphs, and tables.

Forced Response: Written words or phrases that students elicit as a result of being presented with a particular stimuli. When the correct responses are paired with their associated stimuli, they constitute a logical, written narrative describing one of the demographic or geographic characteristics of the United States or Mexico.

Inferential: A qualifier added to this self-instructional mode because the student does not merely associate unequivocal factual responses with particular stimuli, but rather he is required to infer certain relationships or consequences from the graphical data base in order to correctly complete a stem. This instructional mode requires the student to elicit responses which are selective and interpretive, as well as factual in nature.

Logical Narrative: A conceptual set of S-R associations that when correctly completed, constitute a written essay that describes some demographic or geographic characteristic of the United States or Mexico.

Population Education: The transmission of knowledge about the methods of analyzing population processes, population characteristics, the causes of population change and the consequences of that change for the individual and society (Viederman, 1971).

Progressive Complexity of the Data Base: Initially the data base from which the responses were derived contained graphics of minimal complexity. The intent was to gradually shape the student's ability to make the proper response discrimination. As the unit progressed, the number of variables in the graphics increased and the type of graphics used became more abstract. This process of progressively increasing the difficulty of the data base was intended to improve the student's ability to use such graphic forms.

Response: A written word, phrase, or sentence elicited by the student in association with a given stimulus.

Reinforcement: The strengthening of correct S-R associations derived from the knowledge of having made a correct response. Since this mode was self-instructional in nature, the student was provided with an answer booklet which enabled him to reinforce all correct S-R associations. When incorrect S-R associations were made, reinforcement was withheld until the correct associations were made.

Stem: A form of incomplete sentence. A series of correctly completed stems read in sequence compose a logical narrative.

Stimulus-Response Reinforcement Model: A conceptualization of learning which explains learning as a process of associations which are connected as a result of responses made to stimuli, which become reinforced through internal or external rewards. According to Silverman (1969), the three principles of S-R learning are stimulus, activation, and response, which are discussed in Chapter III.

The implications of the questions raised in this study and the use of the defined terms are elaborated in the review of the literature, subject of the next chapter.

# CHAPTER II

# REVIEW OF THE LITERATURE

This review of the literature was concerned with two topics pertinent to this study--the relationship of FIRM to S-R theory and the relationship of FIRM to the use of graphics. A third aspect of the review of the literature dealt with the need for middle grade materials in population geography. This aspect of the literature is treated in Chapter III, in connection with materials development.

## FIRM: Possible Alternate Form of the S-R Reinforcement Model

The relationship of learning theory to curriculum materials development largely rests upon the logic of the researcher and not the experimental design which tests the appropriateness of the materials or comparative effectiveness. The assertion that a particular curriculum rests upon a particular learning theory is neither confirmed nor rejected by the experimental findings. A curriculum may be appropriate by grade level and facilitative as measured by pupil achievement and still fail to be logically convincing as to the relationship of the alleged theory and its product. The limitations of building curriculum upon a determinant

learning theory are at least two fold: The logic of the researcher may be deficient in translating theory into materials, and his curriculum interpretation of the learning theory may not be subject to independent replication.

With these hazards in mind, it was nevertheless considered important for research within the Geography Curriculum Project to relate the conceptualization of FIRM to learning theory. Based on his analysis of both theoretical formulations of S-R theory and their practical applications in the form of programmed texts, the researcher considers it appropriate to regard FIRM as an alternate form of the S-R reinforcement model.

Programmed instruction is one of the most common applications of the S-R reinforcement model to verbal learning (Bigge, 1964). If these programs rest upon S-R theory, and if FIRM has many of the applied characteristics of these programs, then it appears to follow that FIRM might be interpreted in accordance with the S-R reinforcement model.

A useful point of relating S-R theory to FIRM thus appears to begin with examining the characteristics of programmed instruction. From the standpoint of applied learning procedures, FIRM has several characteristics with programmed instruction. Among these gross similarities are

1. Careful specification of learning outcomes.
2. Task categoric selection of content to facilitate learning outcomes.

3. Presentation of learning tasks in small, organized, sequential steps.

4. Active involvement of the learner, with the learner constructing his own responses from the data supplied.

5. Reinforcement through feedback which allows the learner to monitor his own responses.

6. Differential, self-instructional pacing permits the learner to adjust time in learning to his own learning needs.

The similarity of FIRM to programmed instruction therefore impelled the researcher to examine the relationship of S-R theory to FIRM. Inherent in the S-R reinforcement model is the analysis of student behavior in relation to the association of stimuli and responses. Learning is represented as the change in S-R associations that occur when reinforcement is properly used to strengthen correct S-R pairings (Silverman, 1969).

FIRM presented students with sets of related stimuli in the form of incomplete written sentences. These sentences were constructed and sequenced to draw the attention of the studen to the population variables presented visually in the data base. The sentences were designed to restrict the range of searching behavior on the part of the student.. The incomplete sentence forced the student to make a response. He was not provided alternate responses from which to choose, but had to construct his response using the data in the graphic. In the language of Silverman (1969), the stimuli were structured to increase their attention-provoking

properties and to reduce the possibility of confusion with other cues in the data base.

The responses that the students were to associate with these stimuli were selected from a visual data base which accompanied each set of stimuli. Because of the geographic and demographic character of the content in this unit, the data bases were presented in graphical form. Thus the student was presented with a written stimulus and was forced to differentiate the correct response from a data base composed solely of various types of graphics.

The feedback component of the S-R reinforcement model was presented in FIRM in the form of a student answer booklet. This booklet was designed to fit the self-instructional format of the unit. Students were instructed to refer to the answer booklet after matching each set of stimuli with their responses. When the responses that had been elicited by the student were correct, reinforcement in the form of knowledge of having made a correct response was provided. If an incorrect S-R association was made, reinforcement was withheld until the correct association was made.

FIRM, it therefore seems, may be interpreted as an alternate form of the S-R reinforcement model that has inherent similarities to, and yet differences from, the two most commonly used types of programs, the Skinnerian linear type and the branching or intrinsic type. Appendix B compares some of the characteristics of branching and linear

programming as outlined by Klaus (1965) and Lumsdaine (1960) with those of the FIRM alternative. However, the distinctions among the linear, branching, and FIRM reinforcement models are not so much ones of opposing methods as ones of different emphasis.

## Background to S-R Theory

The experimental materials of this study consisted of FIRM and were compared with a narrative text supplemented with graphics. FIRM, in the judgment of the researcher, may be considered as an alternate application to curriculum of the S-R reinforcement model. Learning by reinforcement has been referred to by Skinner as operant learning or operant conditioning (1968).

Operant conditioning in its simplest form occurs when the learner that is responding is in a relatively free response situation. The learner generally has some deprivation--such as a lack of food. Under proper stimulus conditions, any response which is in the direction of the desired terminal response is followed by reinforcement and the deprivation is reduced. This increases the probability that the response will be elicited in the future under similar stimulus conditions. This process of repeating the stimulus and successively rewarding more precise responses is referred to by Gagne (1970, p. 110) as "shaping." Thus, the learner is guided into making more desired terminal responses through a

series of rewards that follow successively closer approximations of the desired behavior (Valentine, 1971).

In this study, the type of learning that Skinner called operant conditioning will be referred to as stimulus-response learning. This phrase was chosen because this type of learning involves a single S-R connection and because the S and R become bound together in a way that does not happen in lower orders of learning (Gagne, 1970).

The S-R reinforcement model consists of a particular form of behavioral analysis. It calls attention to responses, reinforcements, and stimuli. In doing so, it indicates three essentials for learning: (1) the stimulus-control principle, (2) the activation principle, and (3) the reinforcement principle (Silverman, 1969). The task of operationalizing this model required the researcher to first examine the components of this model, and then to structure the materials so they included all of the basic principles inherent in the learning theory. In this application of S-R theory, the stimulus-control, activation, and reinforcement principles were operationalized in the following manner.

## Stimulus-Control Principle

The FIRM format paid careful attention to the construction of stimuli in a clear and unambiguous manner. These stimuli assumed the operational form of incomplete declarative sentences whose structure and sequence were designed to facilitate easy stimulus discrimination by the student.

Activation Principle

The second essential for learning included in the S-R model is the activation principle. This principle involves a three-fold task of identifying desired responses, familiarizing students with responses not in their learning repertoire, and extinguishing incorrect responses that compete with the desired response.

The task of identifying the desired responses involved examining the stimulus stems and determining what word or phrase had been omitted. In most instances, the desired response was a proper name or a number that could easily be presented in a map or graph. All responses were presented in a visual data base that was located on the page opposite the stimuli which the data base accompanied.

The task of teaching technical terms not already in the student's learning repertoire was very important in the study because the content area of the population education unit was largely foreign to the students at this grade level. To facilitate this process, terms that were thought to be novel to the student were defined in the graphic accompanying the stem so that the proper response discrimination could then easily be made from the data base. For example, in introducing the phrase "population variable (Appendix H, p. 13)," the stem appeared as:

A population variable is a ... of a population that can change.

The response "trait" was presented in the key to the adjoining graphic, which also provided the full definition of population variable. This procedure was followed throughout the unit for providing definitions of terms thought to be unfamiliar.

The final step in the activation process was to determine which responses might compete with the desired responses and to reduce their probability of occurrence. Under the FIRM format, the structure of the data base was designed to facilitate inferential discriminations. When incorrect responses did occur, they were not strengthened by reinforcement, and thus were weakened and gradually extinguished.

Reinforcement Principle

The third major principle inherent in operationalizing the S-R reinforcement model was the reinforcement principle. This principle had two major aspects, the identification of a suitable type of reinforcer and the selecting of an appropriate schedule for providing reinforcement. The first aspect required a determination of those reinforcers which would effectively strengthen the responses to be learned. This reinforcement can result from external rewards such as praise, or being presented with a need-satisfying object such as food or candy, or the reward can satisfy an internal desire for achievement or a desire to satisfy curiosity about a particular subject. The FIRM strategy used internal rewards

in the form of providing the student with knowledge of his achievement as its mode of reinforcing desired behavior. This strategy was operationalized in the form of a student answer booklet which was used to check student responses.

The second part of the reinforcement principle involved the effective scheduling of reinforcement. Under the FIRM format, reinforcement was provided after the completion of each conceptual set rather than after each correct S-R pairing. This delayed schedule of providing reinforcement differentiates FIRM from the linear and branching types of programs.

## Research in Programmed Instruction Directly Related to the Study

A review of the related research on the operationalized forms of S-R learning revealed that most of the studies pertained to the structure and use of programmed materials. Since most programmed instructional materials and the Forced Inferential Response Mode are based on S-R theory, the researcher examined some recent programmed learning studies, two of which directly related to this research.

One such study by Ryan (1967) examined four methods of organizing programmed materials: (1) programmed text and then readings on the same topic; (2) readings, then the programmed text; (3) a programmed text supplemented with selected map activities; and (4) the programmed text only.

The conclusion reached at the end of the research was that programmed materials supplemented with other media

increased criterion performance. Ryan's recommendations for integrating media and other techniques of instruction with programming are of interest because the Forced Inferential Response Mode uses the S-R reinforcement model, which is the basis of most programmed materials, and incorporates it with a forced use of graphic media.

A study conducted by Wood (1964) compared classes using a combination of programmed materials and teacher-led instruction with classes using the common teacher-led method of teaching ninth grade geography. The findings from this study showed that students using the programmed instructional materials learned factual material significantly better than those using only the teacher-led technique. These findings were of particular interest because the unit, "Population Growth in the United States and Mexico," presents mainly factual content material. This research also showed no significant difference in the ability of students in the two groups to apply the material learned in the unit to new but similar situations.

## Related Research on the Grade Placement and the Various Uses of Graphic Illustrations

In the application of the FIRM instructional strategy for the presentation of a population goegraphy unit, it was decided to construct a data base composed solely of graphics. This decision prompted a review of the literature related to grade placement and the effectiveness of visuals used in

social studies texts. This review was expanded to include studies that compared the relative effectiveness of graphics used in differing roles. These studies were included because the characteristics of the two instructional formats compared in this study used graphical media to serve differing functions.

Grade Placement

Studies pertaining to the use of graphical materials with primary and intermediate grade students were surveyed to determine if students in these grades were sufficiently mature to use graphics in learning social studies concepts. From the following review of these studies, the use of graphics in a unit designed for grades 5, 6, and 7 was therefore deemed appropriate.

Thomas (1933) conducted an experiment to determine if students in the upper elementary grades could derive information from various types of graphics. He selected his samples from middle grade populations and placed students in categories of slow, average, or superior for each grade level. The results of this experiment showed that students ranked as low as a grade four superior could read simple facts and understand the meaning of graphs.

Thomas' conclusion that middle grade students could derive information from various types of graphics was supported by a study conducted by McAulay in 1964. The purpose of

McAulay's research was to determine if fourth grade students were sufficiently mature to learn map reading skills and utilize them in the learning of social studies concepts. The results of this study indicated that the treatment groups that used maps of Pennsylvania in their study of the state scored significantly higher than those that relied solely upon books and pictures. This research indicates that graphics can be employed as learning tools by students as low as grade 4.

This is not to say that the fourth grade is the lowest level at which graphics can be effectively used. To the contrary, research by Savage and Bacon (1969) indicated that graphic skills can be taught in the primary grades.

Uses of Graphic Illustrations.

The question of how graphic illustrations are used and how they can be used more effectively to teach social studies content was basic to this study. Davis (1968, [b]) outlined three roles that graphic illustrations play in social studies texts today:

1. In a very few instances they are used as a primary source of content materials or the principal means of message communication.

2. More often, graphic illustrations are used to abstract or reinforce ideas already presented in written narrative form. In this role they provide a visualization of concepts and ideas already presented in a written form.

3. Maps, charts, and graphs are not directly related to the transmission of content material; but rather they are used to provide flavor and add atmosphere to the text.

Examples of graphics used in the third manner are quite common in elementary geography textbooks. In these books, maps are included as a part of the text. The student is not instructed to use them as a primary data source, nor is the map expressly used to reinforce or abstract data presented in the written body of the text.

It is essential that a developer of curriculum materials recognize the various roles that graphics play so that the success or failure of the graphics used in materials can be assessed. It is also important that a curriculum developer have an understanding of which role is most suitable to meet the needs of the population that the materials will serve. He can then design his graphics to fit the role that will meet his instructional objectives.

In the literature on the use of graphics, most studies have dealt with graphics in only one of the three roles outlined by Davis. One researcher that did make an inter-role comparison was M. D. Vernon (1952). In a study using English Air Force cadets, she compared treatment groups using only graphic materials with groups using a continuously written text illustrated graphically. The content material involved the demographic characteristics of the English population during World War II. The results of this experiment indicated

that only comparatively intelligent and well-educated cadets could derive information from graphics presented without written material.

Other studies have investigated the effectiveness of graphics as the principal source of content, or as abstractors, reinforcers, or visualizers. The studies that related to graphics in their first role (principal source of content) were primarily concerned with the ability of students to derive information from various types of graphs and charts. Such studies commonly compared the effectiveness of two or more forms of graphics for presenting similar content material.

Wrightstone (1926) used junior and senior high school students to compare the value of conventional graphs with pictorial graphs in presenting data. This experiment tested the student's ability to interpret data directly from the graphs as well as the student's ability to recall the data. His findings showed that groups using the pictorial graphs were able to locate facts in the graphs at a significantly higher rate, but the difference in the level of recall between the groups was not significant.

Washburne (1927) utilized junior high school students to compare various graphic, tabular, and textual methods of presenting quantitative material. He concluded the arrangment of such material was much more vital to recall than the quantity of material presented.

Croxton and Stryker (1929) compared the use of bar charts and circle diagrams. They concluded that when graphs express only two proportions, the pie graph is read more accurately if the proportions are 50-50 or 25-75. There is little difference, however, in which form is used if the figures express other proportions.

In a similar study, Croxton (1932) compared the effects of bars, squares, circles, and cubes with larger and smaller sums. He concluded that there was no difference in accuracy in interpreting circles and squares, but he found both to be superior to cubes.

In a more inclusive study of the ability of individuals to interpret data from various graphic forms, Peterson and Schramn (1954) used 86 subjects at Sampson Air Force Base to assess the accuracy with which the subjects interpreted data from eight types of graphs (circle, disc, single bar, multiple bar, multiple cylinder, multiple square column, multiple area column, and partial cosmograph). The results of this study indicated that the form of graphics used significantly affected the accuracy with which they were interpreted. When showing the parts of a whole, the circle and the multiple area column graph were read least accurately.

Research on the value of using graphics in their second role (reinforcer or visualizer) has been conducted by a number of researchers. In the second part of the previously mentioned study by Vernon, samples were selected from sixth

grade students to determine if graphics assisted in clarifying material and led to a better understanding of the general argument in the written text. Vernon concluded that the written argument was not made easier to understand and retention was not improved by using graphs with the written text.

In a later study, Vernon (1956) tried to assess the value of pictures to illustrate verbal text. The results from this research indicated that pictures might stimulate some people to read an article, but there was no indication that they helped to promote understanding.

Another researcher who explored the effectivness of using graphic illustrations with written text materials to promote learning of social studies concepts was O. L. Davis (1968, [a]). In a very broad study, Davis compared the performance of two groups of junior high school students. The first group was given three narratives illustrated with time lines, distribution maps, and bar graphs. The second treatment group received the same three narratives but they were not given the graphics. The reported results indicated that the use of the time line and distribution maps did not affect performance on a criterion test. The bar graph, when presented with the narrative, did facilitate learning. A third finding of the Davis study had direct bearing on this experiment--analysis of covariance was found to be more precise than analysis of variance in assessing group performance

because the analysis of covariance would adjust the criterion scores for relevant covariants. Davis used IQ scores and reading achievement scores as covariants.

Earlier experiments conducted by Davis and Hicks that related tangentially to the value of using graphics in their second role (reinforcer) were conducted in the spring of 1966. Davis and Hicks evaluated the use of a time line for promoting pupil learning of chronological relationships. The performance of three groups of senior high school students was compared. Treatment 1 had a narrative plus a correctly drawn time line. Treatment 2 had the same narrative with an incorrectly drawn time line. Treatment 3 had only the written narrative. There was no significant difference between Treatments 1 and 2. Both Treatments 1 and 2 were more effective than Treatment 3. Davis generalized from this study that some illustration of chronological relationship, no matter whether it was correct or not, was superior to the narrative used alone.

Davis' conclusion that graphics used as reinforcers and visualizers promoted learning was not supported by similar research in other content areas. Burdick (1959) tried to evaluate the use of various types of graphics to improve the comprehension of written secondary level science materials. This study compared two treatment groups. The first used a written passage supplemented with a cross-sectional drawing, and the second used a perspective-cutaway

drawing. The third treatment group used only a written passage. The results showed no measurable difference in comprehension of the written passage among the three treatment groups.

This review of the effectiveness of graphics in instruction is equivocal. It shows that a variety of graphic forms, as employed in the population unit, have been previously utilized in graphic research.

## Summary

This review of the related literature provided a background for S-R theory and cited several studies that used this theory in the operationalized form of programmed instruction to teach factual social studies content. The value of using graphic media with this model was also explored. No research directly related to the FIRM operationalized form of the model was reviewed because this is a new and previously untested form of the S-R reinforcement model. This study provides an evaluation of the effectiveness of this learning strategy for the presentation of a social studies unit to middle grade students.

Since the unit tested in this research was graphically oriented, the suitability of using graphic media with intermediate grade students was substantiated by several studies. The various roles which graphics can assume in social studies texts was also explored. The conclusions derived from this survey indicated that most of the research into the uses of

graphics was limited in scope to examining graphics used in only one of the three roles outlined by Davis. The only study surveyed that compared the use of graphics on an inter-role basis indicated that graphical illustrations used as primary conveyors of content material were of value to only intelligent and well-educated people.

This study makes a contribution to graphics research by comparing the performance of treatment groups that used graphics as primary and supplementary sources of information. FIRM used graphics as a visual data base; the alternate treatment used graphics to reinforce the information presented narratively.

# CHAPTER III

## DEVELOPMENT OF MATERIALS USED IN THE STUDY

This chapter presents the rationale for the selection of population geography as the content area for the middle grade social studies unit which was developed as a part of this study. In addition, it describes the objectives on which the unit was based and the structure and sequence of the content presented in the unit, "Population Growth in the United States and Mexico." The final portion of this chapter describes the components of the instructional unit which include treatment books, answer booklets, glossary of unfamiliar words used in the materials, pronunciation tapes, standardized tests, and criterion posttests.

### Materials Development

Prior to the actual research, the development of a unit of materials entitled "Population Growth in the United States and Mexico" was undertaken. This unit was to serve as the vehicle for testing the FIRM instructional strategy against a written narrative that used graphics as reinforcers and visualizers.

Content Rationale

The need to improve population education in American education was noted by Hauser as early as 1962. He noted that "The facts and implications of population change are indeed conspicuous by their absence or by their superficial and cursory treatment in American education (p. 424)." A decade after this observation by Hauser, Viederman indicated in a report on the status of population education in the United States that a deficiency in population content material still exists and that the population education program in American schools is still inadequate (Viederman, 1972).

This researcher assumed the task of trying to reduce this deficiency by developing a unit on population geography appropriate for use by students in the middle grades. This unit utilized a comparative approach in analyzing population growth in the United States and Mexico. These two countries were selected because they are commonly studied as a part of the middle grade social studies curriculum. An additional consideration in the selection of Mexico and the United States was that these countries are both New World nations that came under European influence in the 16th and 17th Centuries. These nations were also chosen because of differences in the indigenous groups and the ways in which Spanish and English cultural heritages have contributed to profound differences in the social and economic conditions in these nations today. These differences have so affected population dynamics in

Mexico and the United States over the past 300 years that they offer two countries of sharp population contrast today.

Structure of the Unit

A review of population materials currently available for use with elementary and middle grade students showed that many of the units had objectives of an affective rather than a cognitive nature. (See Appendix A for a state-by-state review of materials.) Titles such as "Science and Survival," "Disaster," and "Resource Units on Population Pressure" indicate that the developers of such materials view the present world's demographic situation as a grave problem.

In contrast, "Population Growth in the United States and Mexico," with other conceptual units of the Geography Curriculum Project, emphasizes cognitive objectives. These units attempt to follow the suggestion of Viederman (1971) that population should be viewed as a phenomenon to be understood and not as a problem to be solved. It is the purpose of the Geography Curriculum Project materials to inform students, not to indoctrinate them.

To meet this objective of presenting population as a phenomenon to be understood, the unit describes population changes in the United States and Mexico. The unit points out some of the factors that were instrumental in causing changes in each nation's population, but does not try to evaluate whether these factors had a positive or negative effect on the living conditions in each country. In Part 3,

some projected estimates are made, derived from the United States Census Bureau and the Population Reference Bureau. These figures represented median rather than extreme estimates.

To develop a cognitively structured unit on the population changes in Mexico and the United States, a conceptual outline was developed, mainly following the topics that Hauser (1962) listed to be essential elements of a population course. Other population authorities consulted included Trewartha (1969), Peterson (1961), and Zelinsky (1966). The specific authentics by part and lesson set are listed in Appendix J.

FIGURE 1

CONCEPTUAL SCHEME FOR THE DEVELOPMENT OF A POPULATION UNIT

I. TOTAL POPULATIONS

- A. Pre-Columbian Population of Each Region
- B. Population Changes in These Regions Since 1500
- C. Number of Inhabitants in Each Region as of the Last Census
- D. Future Growth Projections Based on Median Estimates

II. COMPONENTS OF POPULATION GROWTH

- A. Mortality
- B. Fertility
- C. Migration
- D. Theory of Demographic Transfer

III. POPULATION DISTRIBUTION

- A. National
- B. Regional
- C. Rural and Urban

IV. POPULATION COMPOSITION

A. Age Structure
B. Sex Ratios
C. Ethnic Groups
D. Economic Characteristics

V. METHODS OF POPULATION RESEARCH

A. Census Characteristics
B. Population Pyramids
C. Construction of Birth Rates, Death Rates, and Migration Rates

This structure was placed in a regional framework and the population changes in the United States and Mexico were analyzed. The factors that caused these changes were pointed out through the presentation of statistical information in the data base to illustrate the magnitude of the changes.

Preparation of Materials

The materials prepared for use in the study consisted of two treatment forms, FIRM and a narrative text; an investigator-constructed posttest; a glossary of words; a pronunciation tape; and introduction and instruction sheets for the teachers and students.

Content in both treatments was presented in a chronological manner. The six topics that received particular emphasis were (1) the causes of the decline of the aboriginal populations; (2) factors that affected birth rates, death rates, and migration rates; (3) the degree of racial mixing that had occurred; (4) the history and rationale for conducting population censuses; (5) the current distributional

patterns of each nation's population; and (6) the geographic and demographic trends in each nation today.

The content materials for the unit were assembled during the researcher's two years at the University of Georgia. During this time, course work in population geography, Caribbean American geography, and urban geography contributed to the researcher's background for writing such materials. The actual materials writing involved three months of research, writing, and revising. The reference sources utilized were the latest and most authoritative available at the University of Georgia library.

The unit that resulted from this research was a comparative study which contrasted the demographic history of Mexico with the demographic history of the United States. The unit was written in two different forms for experimental evaluation. The first form ($T_1$) was prepared for use by the experimental group in the study. The content material in this treatment was organized according to the structure of the Forced Inferential Response Mode (FIRM). The treatment consisted of 3 parts and 41 sets of topically-organized stems which took the form of incomplete sentences. To complete the meaning of the stems, information had to be inferred from the data base. When the stems in a set were correctly completed, the stems constitutued a logical narrative describing a particular facet of population growth in Mexico or the United States.

The data needed to complete these stems was presented in 54 figures located on the pages opposite the stems with which the figures were associated. These figures were professionally drafted and contained a variety of maps, charts, graphs, and tables. In addition to figures and stems, the 96-page FIRM book contained a detailed explanation of the use of the various graphics as well as FIRM practice exercises.

The book was divided into three parts. Part 1 analyzed changes in the Mexican population since 1500. Part 2 contained a similar analysis of demographic changes in the United States since 1500. Part 3 compared the demographic and geographic character of each nation's population in the year 2000. A set of 15 review questions followed each of the three parts. These questions were designed to facilitate a review of the content in each part and to help prepare students for the final test which covered all the materials presented in the unit.

A glossary of all terms that were thought to be unfamiliar to the students was included at the end of the unit. Many of the words defined in the glossary were Indian or Spanish names or specific terms commonly used in geographic or demographic literature. To supplement the glossary, the researcher developed a word tape for use in each classroom. This tape presented pronunciation of the words listed in the glossary.

Treatment 2 was a narrative text. It contained the same content material and the same 54 figures as the Treatment 1 unit. The essays in the Treatment 2 materials were written by filling in the stems in the FIRM treatment and arranging these sentences into logical paragraph form.

Every effort was made to make the content presentation in each treatment identical. Both treatment groups had the same review questions, glossaries, and word tapes. The only differences were the color of the book covers (yellow or blue), the different format of the sets (stems or narrative), and the directions the students were to read for using their materials.

Since both of these treatments were designed for use on a self-instructional basis, it was essential to develop a scheme for reinforcing correct responses and extinguishing incorrect responses. To help fulfill this need, a 47-page answer booklet was developed to be used with both treatment groups. This booklet contained the information needed to complete the stems in Treatment 1 and the answers to the review questions. Although the Treatment 2 group did not need the answers to the stems, they did need to utilize the answers for the review questions. The answer booklet also helped Treatment 2 students to identify major ideas in the narrative.

The FIRM-instructed student was directed to use the answer booklet to correct his work. If the student made an

incorrect response, he was directed to strike out the response and to reexamine the data base to determine the correct response. The correct answer was to be placed directly above the crossed-out answer and then checked again with the answer booklet.

## Tests Used in the Study

The development of materials for the study included the selection of standardized tests to be used to measure student skills and performance and the construction of a criterion posttest.

### Standardized Tests

Three sections of the Iowa Tests of Basic Skills, Form 5, Level 12 were used as the pretest: (1) Test V, Vocabulary; (2) W1, Map Reading; and (3) W2, Reading Graphs and Charts. The same level and form of Tests W1 and W2 were also used as a part of the posttest evaluation procedures.

### Criterion Test

A 50-item, 4-option, multiple-choice test of unit content was used as part of the posttest evaluation procedures (Appendix D). This test was a modified form of the instrument used with the pilot groups (Appendix E). The content validity of the instrument was maintained by developing the questions directly from the instructional objectives of the unit (Appendix C) and by having the director of the Geography

Curriculum Project compare the test items with the content objectives.

The reliability of the criterion test was first computed by the TSSA (Test Scorer Statistical Analysis) program for the pilot test (Wolf and Klopfer, 1963). From this program a three-step approach for using the item analysis was employed to improve the reliability of the posttest used in the field trials. A further discussion of the procedures used to insure the validity and reliability of the criterion posttest is presented in Chapter IV.

# CHAPTER IV

# PROCEDURES AND METHODOLOGIES

Chapter four describes the design used in conducting the experiment, the assumptions inherent in the design, and the limitations of the research. The last part of this chapter outlines the procedures followed in conducting the study.

## Research Design

The research design selected for use in the experiment was the pretest, posttest control group design. The rationale for this selection was based on two principal factors. First, the nature of this design gives two measures of individual performance. The first measure, the pretest, is of special value when dealing with two or more groups that receive alternate treatments. This measure provides the experimenter with the opportunity to control statistically on otherwise uncontrolled variables that are highly correlated with criterion test performance. In the study, reading ability and skill in reading maps, graphs, and tables were considered to be experimentally uncontrollable variables, or covariates, that were highly correlated with criterion test performance. These covariates were measured in the pretest phase of the study by using portions of the Iowa Tests of

Basic Skills. The covariates were measured so that the experimenter could conduct a valid evaluation of the results of the experiment.

A second consideration in selecting this design was that when the design is properly carried out, it effectively controls for the eight threats to the internal validity of a study outlined by Campbell and Stanley (1963).

## Treatment Groups

The total sample for the experiment consisted of 15 intact classrooms, 3 of which were used in the pilot phase, and 12 in the field trials. These classrooms were equally divided into five groups from each of the fifth, sixth, and seventh grades. The students in each of these grades were randomly assigned to either Treatment 1 or Treatment 2.

In Treatment 1 ($T_1$), students used the self-instructional unit, "Population Growth in the United States and Mexico," organized according to FIRM (Forced Inferential Response Mode).

In Treatment 2 ($T_2$), students used the self-instructional unit, "Population Growth in the United States and Mexico," organized in a written narrative supplemented with graphics.

## Teacher Participation

Eight middle grade teachers from Clarke and Oconee Counties, Georgia, participated in the study. All were women and experienced teachers. The teachers' participation

in the experiment was on a voluntary basis. There was no remuneration for their efforts. The role of the teacher in the study was limited to giving preliminary instructions, distributing materials to students, and scheduling evaluations. Although the teachers were present in the classrooms, their interaction with the students was kept to a minimum due to the self-instructional nature of the units. The researcher visited all classrooms on numerous occasions to explain the purposes of the experiment and to insure that procedures were being properly followed.

## Assumptions of the Study

The following assumptions were basic to the study:

1. The nature of these materials was so new and unique for use at this grade level that a pre-test of content would have been of no value.
2. Outside variables were controlled for by the random assignment of subjects to treatment groups.
3. The Iowa Tests of Basic Skills provided an accurate measure of pre-experiment skills in reading, map, and graphic skills.
4. The standardized tests and the test developed for the study were valid measures of the desired learning outcomes.
5. The teachers followed the directions given them and made every attempt to minimize teacher-student and student-student interaction.
6. The use of the analysis of covariance provided a method of adjusting for correlated uncontrolled variables so that a valid analysis of experiment results could be made.

## Limitations

The study was carried out with these limitations to internal validity:

1. The use of the Iowa Tests of Basic Skills, Form 5, Level 12, Tests W1 and W2 in both the pretest and posttest parts of the study led to the danger that part of the differences in the pre- and posttest performance could have been due to students becoming "test wise." Alternate forms of these tests were available; however, their inclusion in the total ITBS (Iowa Tests of Basic Skills) battery for grades 3 through 8 made their cost prohibitive for use in the experiment.

2. Perhaps the major limitation of the study was the researcher's inability to control for the time variable. This was the result of the various rates at which the students worked through the units and the numerous interruptions that occurred in the class periods in the various schools. Interruptions such as field trips, assemblies, special speakers, fire drills, and previously scheduled school testing programs all made an accurate assessment of the time spent in learning by each student an impossible task for an experiment including as many subjects as were involved in this study. The researcher noted the advice of English (1971): "Early research most always concentrates all of its efforts in order to demonstrate that a phenomenon can be produced and subsequent research must examine more closely the factors that produced the phenomeonon (p. 3)."

3. Although the materials were self-contained and teacher participation was carefully circumscribed, the study climates of the separate classrooms and schools may have affected learning differentially.

4. The attempt to operationalize FIRM as an alternate form of the S-R reinforcement model was not independently replicated. The FIRM format conforms to the S-R

reinforcement model in the opinion of the researcher, but the study provides no empirical evidence to confirm or reject this assumption.

## Description of the Sample

The sample used in the experiment consisted of fifth, sixth, and seventh grade students from Clarke and Oconee Counties, Georgia. A total of 15 classes participated, of which 14 were drawn from schools in Clarke County. The only class included from Oconee County was a seventh grade class which took part in the pilot phase of the study.

Clarke County is Georgia's smallest county and is located in the northeastern part of the state. The county is largely dominated by the city of Athens, which is the site of the University of Georgia. In 1970, the city of Athens accounted for more than half of the county's total population of 65,177.

As shown in Figure 2 (p. 46), the county's population is predominantly urban in character, with less than 2% of the residents living in households where the chief source of income was derived from farming.

FIGURE 2

URBAN AND RURAL POPULATION OF CLARKE COUNTY: 1960-1980

| Locality | Population | | Projection | |
|---|---|---|---|---|
| | 1960 | 1965 | 1975 | 1980 |
| Urban and non-farm | 44,230 | 52,000 | 67,200 | 74,500 |
| Rural farm | 1,333 | 1,000 | 800 | 500 |
| Total | 45,363 | 53,000 | 68,000 | 75,000 |

The racial composition of Clarke County's population in 1970 showed Whites to outnumber non-Whites by a ratio of nearly 4:1. The county school population showed a ratio of Whites outnumbering non-Whites by 2:1. Since the 1960 census, both the White and non-White segments of the population have increased markedly in their total numbers. Figure 3 illustrates the racial composition of the county.

FIGURE 3

RACIAL COMPOSITION OF CLARKE COUNTY'S POPULATION: 1940-1970

| Year | Whites | Non-Whites |
|---|---|---|
| 1940 | 18,335 | 10,063 |
| 1950 | 26,614 | 9,936 |
| 1960 | 33,748 | 11,615 |
| 1970 | 52,037 | 13,140 |

The rate of population growth for Clarke County during the last ten-year period was 43.7%. This rate ranked Clarke County as one of the ten fastest growing counties in Georgia.

Economic conditions in the county, as reflected by the average income per household, showed Clarke County to be above the state average of $9,355 per year. The county's average of $10,263 was slightly below the national average of $10,565 per household, per year.

A similar pattern of Clarke County's approximation to national norms is reflected in the statistics available on pupil test performance as measured by the county testing program. Results from the Iowa Tests of Basic Skills administered to all fourth and eighth graders in the fall of 1971 showed that pupil performance in the vocabulary portion of this test, as well as the map and graph sections, was closer to the national norms than the state norms. Figure 4 (p. 48) demonstrates the performance comparison for the Iowa Tests of Basic Skills for grade 4.

FIGURE 4

COMPARISON OF CLARKE COUNTY AND GEORGIA 1971 RESULTS

WITH NATIONAL NORMS

IOWA TESTS OF BASIC SKILLS, GRADE 4

| Test / Group | Vocabulary | Reading | Map Reading | Graph Reading | Composite |
|---|---|---|---|---|---|
| National | 41.1 | 42.3 | 41.9 | 41.8 | 41.8 |
| Georgia | 36.4 | 37.6 | 37.7 | 38.1 | 37.7 |
| Clarke County | 39.1 | 40.6 | 41.1 | 40.8 | 40.3 |

Figure 5 demonstrates the performance comparison for the Iowa Tests of Basic Skills for grade 8.

FIGURE 5

COMPARISON OF CLARKE COUNTY AND GEORGIA 1971 RESULTS

WITH NATIONAL NORMS

IOWA TESTS OF BASIC SKILLS, GRADE 8

| Test / Graph | Vocabulary | Reading | Map Reading | Graph Reading | Composite |
|---|---|---|---|---|---|
| National | 80.5 | 81.5 | 82.0 | 81.3 | 81.5 |
| Georgia | 70.7 | 72.8 | 71.7 | 71.8 | 72.0 |
| Clarke County | 77.7 | 78.7 | 80.2 | 77.4 | 77.6 |

This pattern was also evident in the composite score for the total ITBS battery of tests. Clarke County students scored above the state norms and only slightly below the national norms.

This brief glance at Clarke County, Georgia, showed it to be a rapidly growing area that is urban in character. Its population is largely dominated by the city of Athens, and is strongly influenced by the presence of the University in the city. Income levels in the county are much closer to the national average than the state average, and data available on pupil performance reflects this same trend. These factors indicate that in many ways the sample used in this study more closely resembled national norms rather than state norms.

## Sample Selection

The sample selected for use in the field trial of the experiment consisted of 12 intact classrooms from the Clarke County schools. Of these 12 classes, 4 each were from the fifth, sixth, and seventh grades. Figure 6 (p. 50) shows the distribution of the sample population.

FIGURE 6

DISTRIBUTION OF SAMPLE POPULATION

| School | Grade | Number of Classes | Number of Pupils |
|---|---|---|---|
| Barnett Shoals Road Elementary | 5 | 4 | 92 |
| East Athens Elementary | 6 | 4 | 106 |
| Pattie Hilsman Junior High | 7 | 4 | 113 |

The random assignment of students to treatment groups was made at grade level rather than from the total pool of students used in the experiment. This procedure was necessitated because the teachers who agreed to allow their students to participate in the experiment were unable to make their classes available at the same time. The four fifth grade classes at Barnett Shoals Road Elementary School started on May 5. The four sixth grade classes at East Athens Elementary School started on May 8, and the four seventh grade groups at Pattie Hilsman Junior High School began on May 22.

The procedures followed in assigning students to treatment groups were those outlined by Walker and Lev (1953) for use in choosing a sample from a three digit number. This process involved the use of the "Table of 105,000 Random Decimal Digits" published by the Interstate Commerce Commission.

All students were assigned a number according to their alphabetical placement in their class and grade level. This number, selected according to the random selection process, was used to place the students in Treatment 1 or Treatment 2.

To prevent confusion and to facilitate the distribution of materials by the teachers, student names and numbers were typed on labels and placed on the cover of each book prior to their distribution.

The only students not included in the randomizing process were those with reading scores below the fourth grade level. The information regarding these students' reading level was obtained through teacher conferences. The rationale for their exclusion was that students reading at levels below the fourth grade level would have great difficulty with Treatment 2, the written narrative. It was decided by the researcher, after consultation with the teachers, to arbitrarily give those students the FIRM treatment (Treatment 1) because of its more structured nature. It was felt that it would be of more value to these students. The scores obtained from these students' performance on the criterion posttest were not included in the final analysis of the data.

## Test Selection, Construction, and Validation

The material tested in the experiment placed great emphasis on the student's ability to read and his ability to use maps, charts, and graphs, It was therefore necessary

to measure pre-experiment skills of these predictor variables. All students were given three parts of the Form 5, Level 12, Iowa Tests of Basic Skills to assess student skill in these areas prior to the start of the treatments. The parts of the total battery of tests selected for use in the experiment were Test V, a 17-minute vocabulary test; Test W1, a 30-minute map reading test; and Test W2, a 20-minute test of skill in reading graphs and tables.

These tests were selected primarily because of the high reliability of the individual tests: Test V, Vocabulary--.88; Test W1, Map Reading--.71; and Test W2, Reading Graphs and Tables--.71. A second reason for their selection was that the ITBS constitutes part of the Georgia State Testing Program. Thus the use of the tests would most likely be familiar to the teachers and administrators in the schools where the samples were drawn.

The three parts of the ITBS constituted the pretest phase of the experiment, and parts W1 and W2 were also used as a part of the post-experiment evaluation. The purpose for the readministration of these parts of the ITBS was to evaluate changes that had occurred in student skill in using maps and graphs during the experiment.

Content Validity

The second part of the post-experiment evaluation consisted of a 50-item, 4-option, multiple-choice test of unit content. The content validity for this instrument was

assumed to be high based on the test construction procedures followed by the researcher.

The initial step in preparing this test was to construct a list of 6 general and 71 specific instructional objectives (Appendix C). From this list of objectives, 120 four-option multiple-choice questions were constructed. From this pool, 59 questions were selected for use in the pilot form of the criterion posttest. The questions chosen were selected on the basis of their contextual and behavioral characteristics.

After the results from the pilot program were reviewed and analyzed, the number of questions to be used in the field testing form of the criterion posttest was reduced to 50 based on the difficulty and discrimination power of each item. To assure that the content validity of this shortened form of the test had not been adversely affected, a table of specifications (Appendix F) was constructed to compare the content dimension and behavioral dimension of the pilot and field testing forms of the criterion posttest. To further check the content validity, the remaining questions were submitted to the director of the Geography Curriculum Project for review. He audited the test items in terms of graphic and sentence content, unit objectives, and table of specifications. His recommendation that the criterion posttest include more graphic-type items was rejected by the researcher because the inclusion of more graphical questions would have significantly altered the behavioral and content dimension

of the posttest. Moreover, the testing of graphical learning was covered by Tests W1 and W2 of the Iowa Tests of Basic Skills.

## Test Reliability

The procedures followed for determining the reliability of the posttest instrument first involved administering the 59-item form of the criterion posttest to the students in the pilot groups. The results from this test were analyzed by the TSSA (Test Scorer and Statistical Analysis) computer program. This program reported various test statistics and item analysis information. One statistic, the reliability coefficient of the test, was considered to be of special importance because of its value as an indicator of test quality. Ebel (1965) indicates that: "For most tests of educational achievement, the reliability coefficient provides the most revealing statistical index of quality that is ordinarily available (p. 308)." The reliability coefficient and the standard error of measurement of the pilot form of the criterion posttest are presented in Figure 7 (p. 55).

FIGURE 7

TEST ANALYSIS DATA FOR PILOT FORM OF CRITERION POSTTEST

| Grade | Number of Students | Number of Questions | Estimate of Reliability KR20 Method | Standard Error of Measurement |
|---|---|---|---|---|
| 5, 6, 7 | 85 | 59 | .87 | 3.4 |

The TSSA computer program also provided item analysis data that was used to shorten the pilot form of the criterion posttest. From the information provided by this program, the difficulty level of each test item was determined by reviewing the percentage of students that responded correctly to each item. From this data a difficulty index was constructed (Appendix G) which provided a basis for dropping test items that were shown to be too easy or too difficult.

A second procedure followed in revising the pilot form of the criterion posttest involved the determination of the discriminating power of each test item. This index was developed by comparing the number of high-scoring individuals who responded correctly with the number of low-scoring individuals who also responded correctly. This comparison was based on the test score performance. The high-scoring group was composed of the upper third of the class and the low-scoring group was composed of the lower third of the group. This method of dividing the class was used to

prevent overlapping due to the error of measurement in the test. This procedure, along with the index of item difficulty, allowed the investigator to drop ten items from the pilot form of the posttest. Not all of the items that ranked low according to the item analysis procedures could be omitted because of the risk of adversely affecting the validity of the test. This necessitated a third level of item analysis.

The third item analysis procedure was employed to improve those questions that ranked low according to the indices of item difficulty and discrimination. Since the criterion posttest was a multiple-choice instrument that had four alternative answers for each question, the discriminating power of each distractor in these questions was computed according to the "Findley D" procedures (Findley, 1956). This technique provided a way for the researcher to improve the test reliability by changing some of the distractors that ranked low in their discriminating power, rather than dropping questions that were vital in maintaining test validity.

The revised and shortened version of the posttest was used in the field trials. The results were analyzed and the reliability of the test was estimated using the Kuder-Richardson formula #21 and the Saupe $R_{20}$, formula (Payne, 1968). The results of this analysis are shown in Figure 8 (p. 57).

FIGURE 8

TEST ANALYSIS DATA FOR

FIELD TEST FORM OF CRITERION POSTTEST

| Grade | Number of Students | Number of Questions | Estimate of Reliability KR 21 Method | Estimate of Reliability $R_{20}$, Method | Standard Error of Measurement |
|---|---|---|---|---|---|
| 5 | 92 | 50 | .91 | .94 | 3.2 |
| 6 | 106 | 50 | .90 | .92 | 3.2 |
| 7 | 113 | 50 | .91 | .93 | 3.2 |
| Total | 311 | 50 | .91 | .93 | 3.2 |

## Procedures of Pilot Test Phase

The reason for conducting a pilot study was to test the procedures, materials, and evaluation instruments that were to be used in the field testing phase of the experiment. Three classrooms were used for this part of the experiment; two were located in Clarke County schools and one was located in an Oconee County School.

The pretesting portion of the pilot program involved the administration of the Iowa Tests of Basic Skills, Form 5, Level 10, Tests W1, Map Reading, and W2, Reading Graphs and Tables, to all classes. The ITBS, Test V (Vocabulary) was also given. The fifth grade class received Level 11, the sixth grade received Level 12, and the seventh grade received

Level 13. Level 10 of Tests W1 and W2 was used with all grades because of the availability of the tests and knowledge that these tests have a level of difficulty higher than their recommended grade levels.

The results from these tests showed they were suitable for use with all of the fifth grade and most of the sixth and seventh grades. But some of the sixth and seventh grade students did so well on the pretest that it was felt that there was a risk of not being able to accurately measure improvement on the posttest. In an attempt to eliminate this risk, the Form 5, Level 12 of the ITBS was purchased for use by all of the field test groups.

A second change which resulted from the pilot study was the elimination of the detailed time schedule followed by the pilot teachers. The pilot program showed that the fifth grade students would need more time to complete the Treatment 1 books than was originally allotted. The time differential between the two treatments varied from student to student, but it appeared that the Treatment 1 group took approximately 1/3 more time than the Treatment 2 group to complete the unit materials. This led to the use of a very flexible time schedule to assure all students sufficient time to complete their material in the field testing program.

The cost of printing the treatment books precluded revision of materials as a result of the pilot trial. Errors detected in the pilot trial were called to the attention of

students prior to the beginning of the field trial. These errors were minor in nature--a few misspellings and the omission of one answer from the answer booklet.

Another necessary revision that the pilot trial emphasized was the need for a truly randomized treatment assignment. In the pilot trial, teachers were instructed to randomly assign books, but results on the prestest showed the treatment groups not comparable. This problem was alleviated in the field testing by using a table of random numbers to assign students to their groups. This procedure took the responsibility for sample assignment from the teacher and placed it in the hands of the researcher.

The final modification that resulted from the pilot phase of the experiment was test improvement, as previously described (p. 51).

## Procedures of Field Test Phase

From the information gathered in the pilot phase of this experiment, the instruments and procedures were modified for the field testing which began May 8, 1972. The sample selected for use in the field test was composed of 311 middle grade students selected from three schools in Clarke County, Georgia. These students were randomly assigned to treatment groups and were allowed to work through the materials at their own pace.

All students in the study received the Form 5, Level 12, Tests V, W1, and W2 parts of the Iowa Tests of Basic Skills as a pretest, and Tests W1 and W2 as a segment of the post-treatment evaluation procedures. In addition to these tests of skills, a 50-item, researcher-constructed criterion post-test was also administered to all students. The field testing was concluded on May 26, when the last seventh grade classes completed their posttests. Following the completion of the field testing, all tests were collected and hand scored by the researcher. The results from these tests were then sent to the University of Georgia Computer Center for analysis, the results of which are presented in the following chapter.

# CHAPTER V

# FINDINGS AND DISCUSSION OF THE FINDINGS

The first part of this chapter presents a summary of the raw scores for all pre- and posttests that were administered. The results of these tests are reported by treatment group and grade level and the statistical procedures used to analyze these scores is also outlined. This is followed by the presentation of the findings in relation to the hypotheses stated in Chapter I. The last part of the chapter reviews the statistical findings and relates them to the theoretical framework upon which this study was based.

## Background to the Findings

The statistical data that was collected for this study was obtained from the administration of the six tests identified in Figure 9 (p. 62). The results from these tests were analyzed by treatment (Figure 9) and grade level (Figure 10, p. 62) using the MUGALS (Modified University of Georgia Analysis of Least-Squares) computer program. This program provided a univariate analysis of multiple covariance and a Duncan Multiple Range Test so that comparisons among treatment and grade level means could be made.

FIGURE 9

RAW SCORE SUMMARY BY TREATMENT GROUPS

| Test | Treatment 1 Mean Score (154 Subjects) | Treatment 2 Mean Score (157 Subjects) |
|---|---|---|
| Vocabulary Pretest | 27.17 | 27.74 |
| Map Pretest | 20.21 | 19.85 |
| Map Posttest | 23.31 | 23.08 |
| Graph Pretest | 12.69 | 12.96 |
| Graph Posttest | 14.56 | 14.34 |
| Criterion Posttest | 27.62 | 28.00 |

FIGURE 10

RAW SCORE SUMMARY BY GRADE AND TREATMENT GROUPS

| Test / Number of Subjects | Grade 5 | | Grade 6 | | Grade 7 | |
|---|---|---|---|---|---|---|
| | $T_1$ | $T_2$ | $T_1$ | $T_2$ | $T_1$ | $T_2$ |
| | 49 | 43 | 52 | 54 | 53 | 60 |
| Vocabulary Pretest | 26.58 | 24.34 | 26.68 | 29.37 | 28.25 | 29.52 |
| Map Pretest | 17.92 | 15.60 | 18.65 | 20.67 | 25.54 | 21.17 |
| Map Posttest | 23.97 | 20.74 | 22.03 | 23.54 | 24.50 | 24.52 |
| Graph Pretest | 13.03 | 11.18 | 11.79 | 13.05 | 12.73 | 14.29 |
| Graph Posttest | 13.91 | 13.72 | 14.30 | 14.96 | 15.11 | 14.35 |
| Criterion Posttest | 25.78 | 25.09 | 28.47 | 29.47 | 27.63 | 28.71 |

## Findings for Hypothesis 1

The first hypothesis stated in the null form was that if adjustment is made for initial differences in vocabulary, map reading, and graph reading skills, there will be no significant difference in scores on a researcher-constructed criterion posttest between treatment groups. Figure 11 summarizes the data related to this first hypothesis.

FIGURE 11

ANALYSIS OF VARIANCE FOR

MAIN EFFECTS, INTERACTION, AND COVARIATES

ON CRITERION POSTTEST

| Source | Degrees of Freedom | Sum of Squares | Mean Square | F |
|---|---|---|---|---|
| Total Sum of Squares | 310 | 35167.18 | | |
| Model Sum of Squares | 8 | 22907.36 | 2863.42 | 70.54* |
| Error Sum of Squares | 302 | 12259.83 | 40.60 | |
| Grade | 2 | 318.86 | 159.43 | 3.93* |
| Treatment | 1 | 1.07 | 1.07 | .03 |
| Grade by Treatment | 2 | 176.14 | 88.07 | 2.17 |
| Vocabulary Pretest | 1 | 2754.66 | 2754.66 | 67.86* |
| Map Pretest | 1 | 1172.37 | 1172.37 | 28.88* |
| Graph Pretest | 1 | 490.80 | 490.80 | 12.09* |

*Indicates F ratios that are significant at the .05 level.

The F ratio associated with the treatment effect was .03, an extremely low value, so it was not large enough to reject the null hypothesis at the .05 level of significance.

The reason this extremely low F value was obtained is illustrated in Figure 12. This figure shows that when the raw score means of the $T_1$ and $T_2$ groups were adjusted for differences in the predictor variables, they were very nearly the same.

FIGURE 12

COMPARISON OF RAW SCORE AND ADJUSTED MEANS ON THE CRITERION POSTTEST FOR TREATMENT 1 AND TREATMENT 2

| Treatment | Raw Score Mean | Adjusted Mean |
|---|---|---|
| Treatment 1 | 27.62 | 27.82 |
| Treatment 2 | 28.00 | 27.94 |

The second main treatment effect related to the first hypothesis is the effect of grade. The F ratio associated with grade was 3.93, which was significant at the .05 level. An analysis of this effect using the Duncan Multiple Range Test indicated that all grades were not homogeneous with each other.

Figure 13 (p. 65) shows that the performance of grades 5 and 6 on the criterion posttest was homogeneous when the means were adjusted for the predictor variables.

FIGURE 13

SUMMARY OF RESULTS OF THE DUNCAN MULTIPLE RANGE TEST AT THE .05 LEVEL OF SIGNIFICANCE FOR GRADE LEVEL EFFECT ON THE CRITERION POSTTEST

| Grade | Homogeneous With |
|---|---|
| 6 | 5 |
| 5 | 6, 7 |
| 7 | 5 |

This figure also indicates that the performance of grades 5 and 7 were homogeneous. The significant difference that was indicated in the F ratio was between the adjusted means of grades 6 and 7. Figure 14 shows the adjusted mean for grade 6 to be 28.92 while the adjusted mean for grade 7 was 26.52.

FIGURE 14

RESULTS OF DUNCAN MULTIPLE RANGE TEST AT THE .05 LEVEL OF SIGNIFICANCE FOR MEAN SCORES ON THE CRITERION POSTTEST

| Grade | Constant | Standard Error of the Constant | Means |
|---|---|---|---|
| 5 | .33 | .55 | 28.82 |
| 6 | 1.04 | .51 | 28.92 |
| 7 | -1.36 | .52 | 26.52 |

Figure 11 also indicated that the three covariate measures were highly correlated with criterion test performance so that they were appropriate for use as predictor variables.

## Findings for Hypothesis 2

The second hypothesis stated in the null form was that if adjustment is made for initial differences in map reading skills, there will be no significant difference in scores on a standardized posttest of map reading skills between the treatment groups. Figure 15 summarizes the data related to the second hypothesis.

FIGURE 15

ANALYSIS OF VARIANCE FOR
MAIN EFFECTS, INTERACTION, AND COVARIATES
ON MAP SKILLS POSTTEST

| Source | Degrees of Freedom | Sum of Squares | Mean Square | F |
|---|---|---|---|---|
| Total Sum of Squares | 310 | 20873.96 | | |
| Model Sum of Squares | 6 | 13191.15 | 2198.52 | 86.99* |
| Error Sum of Squares | 304 | 7682.81 | 25.27 | |
| Grade | 2 | 48.81 | 24.40 | .97 |
| Treatment | 1 | .35 | .35 | .01 |
| Grade by Treatment | 2 | 41.73 | 20.87 | .83 |
| Map Pretest | 1 | 12450.13 | 12450.13 | 492.64* |

*Indicates that the F ratio is significant at the .05 level.

The F ratio associated with the treatment effect for this comparison was .01, an extremely low value, so it was not large enough to reject the null hypothesis at the .05 level of significance.

The Duncan Multiple Range Test indicated that Treatment 1 and Treatment 2 were homogeneous with each other and that the adjusted mean performance on the standardized map test was homogeneous for all grade levels.

### Findings for Hypothesis 3

The third hypothesis stated in the null form was that if adjustment is made for initial differences in graph reading skills, there will be no significant difference of scores on a standardized posttest of graph reading skill between the treatment groups. Figure 16 (p. 68) summarizes the results of the analysis of the data related to the testing of the third hypothesis.

FIGURE 16

ANALYSIS OF VARIANCE FOR

MAIN EFFECTS, INTERACTION, AND COVARIATES

ON GRAPH SKILLS POSTTEST

| Source | Degrees of Freedom | Sum of Squares | Mean Square | F |
|---|---|---|---|---|
| Total Sum of Squares | 310 | 11104.98 | | |
| Model Sum of Squares | 6 | 5333.26 | 888.88 | 46.82* |
| Error Sum of Squares | 304 | 5771.72 | 18.99 | |
| Grade | 2 | 30.01 | 15.00 | .79 |
| Treatment | 1 | 8.01 | 8.01 | .42 |
| Grade by Treatment | 2 | 59.78 | 29.89 | 1.57 |
| Graph Pretest | 1 | 5234.93 | 5234.93 | 275.73* |

*Indicates that the F ratio is significant at the .05 level.

The F ratio associated with the treatment was .42, which was not large enough to reject the null hypothesis at the .05 level of significance.

The Duncan Multiple Range Test compared the adjusted means for the Treatment 1 and Treatment 2 groups and found them homogeneous.

The F ratio associated with the second main effect, grade level, was .79, which was also not large enough to be significant at the .05 level. The Duncan Multiple Range

Test compared the adjusted means for all grade levels and showed them to be homogeneous.

## Discussion of the Findings

The findings of this study were reported in relation to the treatment effect and grade effect. The data was analyzed using an univariate least-squares analysis of covariance and was reported in terms of the three original hypotheses stated in Chapter I.

The main treatment statistical hypothesis, that there was no difference between treatment groups using the materials organized according to the Forced Inferential Response Mode learning format and those using materials presented in the form of a written narrative, could not be rejected for any of the three hypotheses tested.

The grade level effect was not significant for the second and third hypotheses which compared performance on the post-administration of the Iowa Tests of Basic Skills, Form 5, Level 12, Test W1, Map Reading, and Test W2, Reading Graphs and Charts. Grade level performance was significantly different when comparing the adjusted means for the criterion posttest. This difference was illustrated in the results of the Duncan Multiple Range Test which indicated that while the performance of grades 5 and 6 and 5 and 7 were homogeneous, the performance of grades 6 and 7 were significantly different.

The results of these findings indicated that the differences in gains between treatment groups were not statistically significant. However, the students in both treatment groups significantly improved their skill in reading maps and graphs between the administration of the pre- and posttest.

Figures 17 and 18 present a comparison of the pre- and posttest raw mean scores on the map reading and graph reading tests.

FIGURE 17

MEAN DIFFERENCE BETWEEN PRETEST AND POSTTEST SCORES ON THE TEST OF MAP READING SKILLS

| Treatment Groups | Test Means | | Degrees of Freedom | t | Level at Which the t-Ratio is Significant |
|---|---|---|---|---|---|
| | Pretest | Posttest | | | |
| $T_1$ | 20.21 | 23.31 | 306 | 3.35 | .01 |
| $T_2$ | 19.85 | 23.08 | 312 | 3.55 | .01 |

FIGURE 18

MEAN DIFFERENCE BETWEEN PRETEST AND POSTTEST SCORES ON THE TEST OF GRAPH READING SKILLS

| Treatment Groups | Test Means | | Degrees of Freedom | t | Level at Which the t-Ratio is Significant |
|---|---|---|---|---|---|
| | Pretest | Posttest | | | |
| $T_1$ | 12.69 | 14.56 | 306 | 2.65 | .01 |
| $T_2$ | 12.96 | 14.34 | 312 | 2.03 | .05 |

These scores indicated that significant learning gains occurred for both treatment groups on both tests. On the test of map reading skills, the $T_1$ and $T_2$ groups both achieved learning gains that were significant at the .01 level. Similarly, significant improvement was made by the $T_1$ group on the graph reading test, while the $T_2$ group had a t-ratio of 2.03 which was significant only at the .05 level.

Results from the criterion posttest showed no significant difference between the treatment groups. The unadjusted mean score for all students in the sample was 28.81. Since this score was far above a pure chance score on a 50-item, 4-option, multiple-choice test, it was interpreted as showing that students using the $T_1$ and $T_2$ materials significantly increased their knowledge of the demographic and geographic characteristics of the United States and Mexico.

## Survey of Student and Teacher Reactions

Following the completion of the field testing phase by the seventh graders at Pattie Hilsman Junior High School, a survey was conducted to assess student reaction to the content and the treatments. The majority of students in both treatment groups reported that they had enjoyed working with the unit materials and that they thought the content area was interesting and important. The percentage of students who reported positive reaction to the materials was greater than 75% for both treatment groups, with slightly more

students in the $T_1$ than the $T_2$ group expressing postive reactions toward the unit.

One variable that may have contributed to the generally favorable attitude of students toward the unit was that the school in which the survey was conducted was involved in an environmental education campaign, and most students viewed population growth as a phenomenon closely related to the environmental controversy.

No formal survey of teacher reaction toward the unit was conducted, but the researcher had almost daily conversations with the participating teachers. These teachers seemed to feel that short, self-instructional units on important topics such as population growth were of great value to the students. There was also a general attitude among the teachers that the more structured format of the FIRM treatment was more suitable for their slower students, and that the FIRM treatment was of greater value in promoting skill development in all of their students.

Before basing firm conclusions on the data collected in this study, it is necessary to review these findings in light of the major limitations to internal validity of the study. The first stated limitation was the use of the Iowa Tests of Basic Skills as both a measure of the predictor variables of pre-treatment skill in vocabulary, map reading, and graph reading, and the use of the same instruments for measuring post-treatment gains in map and graph reading skills. This

not only led to the danger of students becoming test wise, but the standardized nature of the tests provided a more general measure of graphic skills and did not include specific types of graphics that were emphasized in the population content materials used in the study. Although an alternate form of these tests was available, their inclusion in booklet form in the total battery of Iowa Tests of Basic Skills for grades 3 through 8 made the purchase cost of the alternate form prohibitive.

The second limitation to internal validity stated in Chapter III was the inability of the researcher to control for the amount of time each student spent in learning. This factor may have substantially affected each treatment group's performance because the groups using the FIRM format required more time to study the graphics from which the differentiated responses were to be paired with the proper stimuli. The Treatment 2 group simply read the narrative and used the graphics to provide visualization and reinforcement for the concepts they had already encountered in their reading.

In conclusion, the data collected in this study does not support the hypothesis that the FIRM instructional alternative is superior to the written narrative format supplemented with graphics for the teaching of population geography concepts, or for the teaching of map reading and graph reading skills to middle grade students. Rather, it indicates that both treatments made significant contributions

to concept learning and skills development among the students tested.

# CHAPTER VI

# SUMMARY, CONCLUSIONS, AND IMPLICATIONS FOR FURTHER RESEARCH

## Summary

This section presents a summary of the research undertaken by the investigator.

### Purpose

This study was conducted under the sponsorship of the Geography Curriculum Project of the University of Georgia and attempted to answer questions that reflected the goals of the Project. The purpose of the research can be stated as an attempt to answer three questions:

1. Can a systematically structured and conceptually organized population geography unit be developed that will be appropriate for use with middle grade students?
2. Is the FIRM instructional format more effective for teaching a population education unit than the more traditional narrative mode supplemented with graphics?
3. Can the FIRM instructional format be considered an application of the S-R reinforcement model?

The third question asked in the study related to the Project's goal of presenting geography curriculum materials in accordance with some accepted learning theory. This was a theoretical question that can only be answered based on

the logic used by the researcher in applying learning theory to the developed curriculum material and cannot be empirically supported by the results of the study.

Procedures

The procedures followed in conducting this study involved first reviewing the literature on the past use of S-R learning theory to teach geography at the middle grade levels. From this review and the past research of the Project Director, Dr. Marion J. Rice, the FIRM instructional mode was conceived and operationally defined.

Since this alternate form of the S-R reinforcement model included a data base composed of conceptual clusters, and because of the geographic and demographic nature of the materials, it was decided to utilize a data base composed solely of graphics. This decision prompted a review of the literature which related to the form and effectiveness of graphical illustrations in social studies texts and also included studies that showed the appropriateness of such media for the middle grades. This survey was expanded to include studies that compared graphics used in different roles because the function that graphics served under the FIRM format differed from the function graphics served in the written narrative form of the unit, "Population Growth in the United States and Mexico."

Following the format of FIRM and the more traditional structure of a written narrative supplemented with graphic

illustrations, two treatment units were developed to present the unit, "Population Growth in the United States and Mexico."

These units were pilot tested at three schools in Clarke and Oconee Counties, Georgia. From these schools, one fifth, sixth, and seventh grade class participated in the experiment. The results from this pilot phase of the study indicated procedural changes were needed and also provided a means for evaluating and modifying the posttest instrument. After analyzing the results of each question of this test according to its difficulty and discrimination power, the test was shortened and modified.

The field testing phase of the experiment involved 311 students from fifth, sixth, and seventh grade classrooms from Clarke County, Georgia. These students were randomly assigned to treatment groups. All students in the sample were given three parts of the Iowa Tests of Basic Skills, Form 5, Level 12, as a pretest, and two parts of the same test as a part of the post-treatment evaluation. In addition to the standardized test, all students were given the revised form of the researcher-constructed criterion posttest. Results from all tests were analyzed by the MUGALS (Modified University of Georgia Analysis of Least-Squares) computer program.

## Findings in Relation to the Stated Hypotheses

The hypotheses stated in Chapter I related directly to the question, "Is the FIRM format more effective for the teaching of population education concepts and map and graph skills than the written narrative format supplemented with graphics?" The data collected in this experiment was based on the performance of groups using the two alternate instructional formats.

The findings of the study supported the hypotheses that there was no significant difference in performance between the treatment groups on a researcher-constructed criterion posttest or in gains on standardized tests of skill in reading maps or graphs.

More specifically, the findings reported in terms of the main effects of treatment and grade are listed below:

1. There was no significant difference between the performance of $T_1$ and $T_2$ on the researcher-constructed criterion posttest when adjustments were made for pre-treatment differences in vocabulary, map reading, and graph reading skills.

2. There was a significant difference between grades 6 and 7 on the criterion posttest in favor of grade 6 when adjustements were made for pre-treatment differences in vocabulary, map reading, and graph reading skills.

3. There was no significant difference between the performance of $T_1$ and $T_2$ on a standardized posttest of map reading skills when adjustments were made for pre-treatment differences in map reading skills.

4. There was no significant difference among the performance of grades 5, 6, and 7 on a standardized posttest of map reading skills when adjustments were made for pre-treatment differences in map reading skills.

5. There was no significant difference between the performance of $T_1$ and $T_2$ on a standardized posttest of graph reading skills when adjustments were made for pre-treatment differences in graph reading skills.

6. There was no significant difference among the performance of grades 5, 6, and 7 on a standardized posttest of graph reading skills when adjustments were made for pre-treatment differences in graph reading skills.

7. There was a significant improvement in map and graph reading skill made by both treatment groups between the administration of the pre- and posttest.

## Conclusions

The conclusions drawn from this study are based on information collected and analyzed in conjunction with the study. These conclusions relate largely to the question of the feasibility of developing a population education unit appropriate for use with middle grade students. The third question asked in this study was "Can the FIRM instructional format be considered an application of the S-R reinforcement model?" An analysis of the relationship of the components of S-R theory to FIRM was discussed at length in Chapter III. The relationship of applied program characteristics of FIRM to programmed instruction, which frequently explains learning in S-R terms, was described in Chapter II.

In the judgment of the researcher, FIRM embodies the specific characteristics of the S-R reinforcement model, as described by Silverman (1969), and the principles of S-R learning, as described by Hilgard (1960). The researcher therefore answers this theoretical question affirmatively, that FIRM may be considered an application of the S-R reinforcement model, within the limitation of the discussion in this chapter. Because of the inferential nature of FIRM, however, another researcher might find it more compatible to explain FIRM as some variation of inquiry learning. As the field of learning theory indicates, similar learning phenomena are frequently interpreted quite differently by learning theorists (Klaus, 1965).

The following conclusions have been drawn by the researcher:

1. Population education curriculum materials can be effectively used by middle grade students.

2. Population education curriculum materials can be structured so that they can be used on a self-instructional basis by middle grade students.

3. The FIRM instructional format can be effectively used to teach population education concepts to middle grade students.

4. The FIRM instructional format can be effectively used to teach map and graph interpretation skills.

5. The FIRM instructional format and the more traditional approach of using a written narrative supplemented with graphical illustrations are both effective strategies for presenting a self-instructional middle grade population unit.

6. The learning gains made by groups using the FIRM format and the written narrative approach are not significantly different.

7. The self-instructional conceptually organized unit, "Population Growth in the United States and Mexico," is every bit as appropriate for use with grades 5 and 6 as with grade 7 when adjustments are made for the predictor variables of pre-treatment differences in vocabulary, map reading, and graph reading skills.

8. Graphical illustrations used in their primary role as conveyors of content, and in their alternate role as reinforcers and visualizers, both produce gains in student ability to read and interpret maps and graphs.

9. Student scores on the Iowa Tests of Basic Skills test of map and graph reading skills will not be significantly different between groups using graphic illustrations in their primary role (conveyor of knowledge) and alternate role (reinforcer and visualizer).

## Implications for Further Research

The conclusions that have been drawn from the analysis of the data collected in this study are generalizable within the limits of the external validity of the study. Implications for further research can be found in the threats to external validity which were inherent in the procedures and design of the study.

Since the study used pre-treatment tests to evaluate skill levels in the areas of vocabulary, map reading, and graph reading, the danger of reaction between the pre-measures and the instructional treatment existed. This danger was assumed to be minimized by the skill nature of the pretest, but further research using the FIRM instructional

format might employ an experimental design that does not include pre-treatment measures.

The sample used in the experiment was drawn from the population of fifth, sixth, and seventh grade students in the schools of Clarke and Oconee Counties, Georgia. Thus, the findings of the study can only be generalized to similar populations that have similar characteristics. This limitation implies the need for further research using the FIRM alternative at different grade levels and with populations that are socially and economically different from those used in this study.

The interaction of the FIRM instructional mode with materials that employ a data base composed solely of graphics suggests the need for further research in which some other form of conceptual cluster might be used to present the responses in place of the graphics.

Since this study made a comparison of graphical illustrations used in the role of content conveyors and content reinforcers, future research may evaluate the effectiveness of graphics used in other ways. An extension of this idea may be to compare graphical illustrations in their varying roles with materials presented in a purely narrative fashion. Past studies conducted by Vernon, Davis, and Burdick have made similar comparisons but their results have been inconsistent and contradictory.

Because the testing phase of the experiment involved the use of standardized tests of vocabulary, map reading,

and graph reading skills and a researcher-constructed criterion posttest, future application of the FIRM format might develop alternate testing programs to evaluate the effectiveness of FIRM.

The unit, "Population Growth of the United States and Mexico," was developed using the structure of population geography, a field which is characterized by the extensive use of statistical information to convey its message. As a result, there was a danger of interaction between the special characteristics of this field and FIRM learning strategy. A second feature of this unit that may have also interracted with the FIRM strategy was the purely cognitive nature of the materials presented. Future applications of FIRM should be made with units that utilize different content fields and with materials that have objectives that are affective in nature. These types of studies will help to define the limits within which this learning strategy can be effectively employed.

Since the generalizability of the findings of this study are limited to comparisons made between FIRM and the written narrative supplemented with graphics for presenting similar contextual material, future research might make comparisons between FIRM and other instructional strategies.

REFERENCES


Bigge, M. L. Learning theories for teachers. New York: Harper and Row Publishers, 1964.

Burdick, J. G. A study of cross-section drawings used as technical illustrations in high school science textbooks. Unpublished doctoral dissertation, Syracuse University, 1959.

Campbell, D. T. & Stanley, J. C. Experimental and quasi-experimental designs for research. Chicago: Rand McNally and Company, 1963.

Clarke County Board of Education. Report of Iowa Tests of Basic Skills scores, 1971. Unpublished report, Athens, Georgia, 1971

Croxton, F. E. Graphic comparisons by bar squares, circles, and cubes. Journal of American Statistical Association, 1932, 27, 54-56.

Croxton, F. E. & Stryker, R. E. Bar charts versus circle diagrams. Journal of the American Statistical Association, 1929, 22, 473-482.

Davis, O. L., Hicks, L. C. & Bower, N. D. The usefulness of time lines in learning chronological relationships in text materials. The Journal of Experimental Education, 1966, 34 (3), 22-25.

Davis, O. L., Jr. Effectiveness of using graphic illustrations with social studies textual materials. ERIC, 1968 (Ed 027 608). (a)

Davis, O. L., Jr. Graphic illustrations with geography text: On exploring a vast unknown. Peabody Journal of Education, 1968, 46 (1), 39-44. (b)

Ebel, R. L. Measuring education achievement. Englewood Cliffs, New Jersey: Prentice-Hall, 1965.

Findley, W. G. Rationale for the evaluation of item discrimination statistics. Educational and Psychological Measurements, 1956, 16, 175-180.

Fund for the Advancement of Education. Four case studies of programmed instruction. New York: Author, 1964.

Gagne, R. M. The conditions of learning. New York: Holt, Rinehart and Winston, Inc., 1970.

George Peabody College for Teachers, Division of Survey and Field Services. Clarke county public schools. Nashville, 1969.

Hauser, P. M. Population-gap in the curriculum. Teachers College Record, 1962, 63 (6), 424-433.

Hebb, D. O. The organization of behavior. New York: John Wiley & Sons, 1949.

Hieronymus, A. N. & Lindquist, E. F. Teachers guide for administration, interpretation and use: Iowa Tests of Basic Skills, form 5 & 6. Boston: Houghton Mifflin Company, 1971.

Hilgard, E. R. Learning theory and its applications. New teaching aids for the American classroom, Symposium presented at the Center for Advanced Study in Behavioral Sciences, Institute for Communication Research, Stanford University, 1960, 19-26.

Klaus, D. J. An analysis of programming techniques. In R. Glaser (Ed.), Teaching machines and programmed learning, II. Washington: Department of Audiovisual Instruction, National Education Association of the United States, 1965, 124.

Kuder, G. F. & Richardson, M. W. The theory of estimation of test reliability. Psychometrika, 1937, 2, 151-160.

Lumsdaine, A. A. The development of teaching machines and programmed self-instruction. New teaching aids for the American classroom, Symposium presented at the Center for Advanced Study in Behavioral Sciences, Institute for Communication Research, Stanford University, 1960, 136-173.

McAulay, J. D. Map learning in the fourth grade. Journal of Geography, 1964, 63 (3), 123-127.

McDaniel, C., Superintendent. Clarke County Board of Education, Athens, Georgia. Telephone conversation, June 29, 1972.

1971 Survey of buying power. Sales management, July 10, 1971, 37.

Payne, D. A. The specification and measurement of learning outcomes. Waltham, Massachusetts: Blaisdell Publishing Company, 1968.

Peterson, L. V. & Schramn, W. How accurately are different kinds of graphs read? Audio Visual Communications Review, 1954, 2 (1), 1978-189.

Peterson, W. Population. New York: The MacMillan Company, 1961.

Rice, M. J. Improving elementary geography. Elementary School Journal, 1965, 66, 126-138.

Ryan, F. L. Four methods of using programmed materials in social studies instruction. Dissertation Abstracts, 1967, 27, 2453-A.

Saupe, J. L. Some useful estimates of the Kuder-Richardson formula #20 reliability coefficient. Educational and Psychological Measurement, 1961, 21, 63-71.

Savage, T. V. & Bacon, P. Teaching symbolic map skills to primary grade children. Journal of Geography, 1969, 68 (8), 491-497.

Silverman, R. E. Using the S-R reinforcement model. Reprint from Educational Technology, Englewood Cliffs, New Jersey, 1969.

Skinner, B. F. The technology of teaching. New York: Appleton-Century-Croft, Inc., 1968, 64-65.

Skinner, B. F. Teaching machines. Scientific American, 1961, 205, 90-102.

Steinbrink, J. E. The effectiveness of advance organizers for teaching geography to disadvantaged rural black elementary students. Unpublished doctoral dissertation, University of Georgia, 1970.

Thomas, G. Evolution. Athens, Georgia: Anthropology Curriculum Project, University of Georgia, 1971.

Thomas, K. C. The ability of children to interpret graphs. The 32 yearbook of the national society of the study of education, 1933, 492-494.

Trewartha, G. T. A geography of population: World patterns. New York: John Wiley & Son, Inc., 1969.

Valentine, C. G. Contingency managements and the design of learning environments. Education Technology, 1971, 2, 66-68.

Vernon, M. D. The use and value of graphical methods of presenting quantitative data. Occupational Psychology, 1952, 36, 22-34, 96-100.

Vernon, M. D. The value of pictorial illustrations. British Journal of Educational Psychology, 1956, 23, 180-187.

Viederman, S. Population education in the United States. Social Education, 1972, 36 (4), 337-346.

Walker, H. M. & Lev, J. Statistical inference. New York: Holt, Rinehart and Winston, 1953.

Washburne, J. N. An experimental study of various graphs, tabular and textual methods of presenting quantitative material. Journal of Educational Psychology, 1927, 18, 361-376, 415-476.

Wolf, R. & Klopfer, L. Test scorer and statistical analysis. Chicago: University of Chicago Computer Program Library, 1963.

Wood, L. A. Programmed textual material as a partial substitute for teacher-led classroom procedures in geography. The Journal of Educational Research, 1964, 58 (1), 22-26.

Wrightstone, J. W. Conventional versus pictorial graphs. Progressive Education, 1936, 13, 460-462.

Zelinsky, W. A prologue to population geography. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1966.

# APPENDICES

# APPENDIX A

## AN ILLUSTRATIVE LIST OF

## POPULATION EDUCATION ACTIVITIES BY STATE

An article has been omitted because of copyright restrictions.
It is: "An Illustrative List of Population Education Activities,"
by Stephen Viederman from Social Education, April 1972, pp.344-6.

# APPENDIX B

## COMPARISON OF CHARACTERISTICS OF LINEAR AND BRANCHING TYPES OF PROGRAMMING WITH THE FIRM ALTERNATIVE BASED ON KLAUS AND LUMSDAINE

COMPARISON OF CHARACTERISTICS OF LINEAR AND BRANCHING TYPES OF PROGRAMS WITH THE FIRM ALTERNATIVE BASED ON KLAUS AND LUMSDAINE

| Components | Linear Program | Branching Program | FIRM Alternative |
|---|---|---|---|
| Stimulus | Commonly an incomplete declarative sentence structured so as to insure as much as possible a correct response. | Commonly a unit of material (usually of paragraph length) to be read and a question designed to determine if learning has taken place. | Incomplete declarative sentence structured so as to necessitate the student's inferring information from a data base to correctly complete the sentence. |
| Response | Response is constructed by the student. It is essential to elicit the correct response in order to effect learning. | Response is commonly selected from alternatives provided in a multiple-choice question. The purpose of the response is to see if learning has occurred. | Response is selected from the data base with the purpose of correctly completing the idea presented in the stem portion of the set. |
| Reinforcement | Provided after each correct S-R pairing. Repetition is provided to strengthen S-R pairings. | Provided after each S-R pairing and used to maintain learner motivation. In the event of an incorrect response, a remedial loop is provided to give the student additional information to bring about the desired learning outcome. | Provided at the end of each conceptual set and is designed to let the student know if he has made correct responses. If an incorrect response is made, the student is instructed to go back to the set and reexamine the stem and data base. |

# APPENDIX C

# POPULATION GROWTH IN THE UNITED STATES AND MEXICO: UNIT OBJECTIVES

# POPULATION GROWTH IN THE UNITED STATES AND MEXICO

## UNIT OBJECTIVES

### General Objectives

The student will be able to:

1. Describe changes that occurred in the population geography of the United States and Mexico between 1500 and 1970.
2. Discuss the primary causes of the changes in the population geography of the United States and Mexico between 1500 and 1970.
3. Describe changes in the composition of the United States and Mexican populations between 1500 and 1970.
4. Describe the growth patterns of the United States and Mexican populations since 1500.
5. Discuss the causes of population growth of the United States and Mexico since 1500.
6. Use various types of maps, charts, graphs, and tables effectively.

### Specific Objectives

Part 1

The student will be able to:

1. Summarize the primary message that a graphic conveys.
2. Identify the major concentrations of Indian population in North America in 1492.
3. Describe the major difference in the distributional pattern of Indians in Mexico and in the United States.
4. Match major Mexican Indian groups in 1519 with their major form of food production.
5. Identify which Indian groups had the highest level of civilization.

6. Describe the event that began the decline of the Indian population in Mexico.

7. List the three major segments of the Mexican population.

8. List the three major causes for the decline of the Indian population in Mexico.

9. Describe the growth of the Mexican population between 1800 and 1920.

10. Explain the causes of the rapid increase in population after 1877.

11. List the states that were wholly or partially included in the territory acquired from Mexico.

12. Discuss the effect of the lost territory on the total population of Mexico in 1848 and today.

13. Identify the changes in growth rate from 1930 to 1971.

14. Define the major population variables influencing population growth.

15. Describe the intervals of the decline of the Mexican birth rate and death rate since 1930.

16. Estimate the growth rate, given the birth rate and the death rate, and assuming no international migration.

17. List the major causes for the decline of the Mexican birth rates and death rates.

18. Define the following terms: international migration, emigration, and immigration.

19. Identify the source and destination of major Mexican international migrations.

20. Describe the general pattern of internal Mexican migration.

21. Describe the major characteristics of rural and urban areas.

22. Identify the major urban centers of Mexico in 1970.

23. Explain the rapid growth of the three major cities along the United States border.

24. Identify the year when Mexico's population became predominantly urban.

25. Give at least one reason that explains the change to an urban composition.

26. Explain how urbanization caused occupational changes in Mexico.

Part 2

The student will be able to:

1. Identify the major causes of the decline of the aboriginal population of the United States.

2. List the European nations that established colonies in the eastern part of the United States between 1492 and 1650.

3. Describe why river valleys were advantageous sites for settlements during the Colonial Period.

4. Interpret information from a proportional circles map.

5. Identify the three primary components of population growth.

6. Identify the two primary sources of immigration to the United States during the Colonial Period.

7. List the primary economic activities of the people of New England, the Middle Colonies, and the Southern Colonies during the Colonial Period.

8. Define the term "census."

9. Identify the primary purpose for conducting a census in the United States.

10. Describe the extent of United States territorial growth between 1790 and 1860.

11. Identify conditions that may "pull" immigrants into a country.

12. Identify conditions that may "push" emigrants from a country.

13. List the three major sources of immigration to the United States between 1790 and 1860.

14. Relate major fluctuations in the rate of immigration to the United States during the 19th Century with historical events in the United States and Europe.

15. Identify three major causes for the decline of the United States birth rate between 1850 and 1900.

16. Identify three major causes for the decline of the United States death rate between 1850 and 1900.

17. Identify the major change that occurred in the source of immigration to the United States between 1860 and 1910.

18. Describe major changes that have occurred in the United States birth and death rates since 1900.

19. List the two nations that sent the greatest number of immigrants to the United States in 1965.

20. Describe the three regional shifts in the sources of immigrants to the United States that have occurred since 1790.

21. Define the term "Mexican American."

22. Locate the greatest regional concentration of Mexican Americans in the United States in 1970.

23. Identify two primary types of internal migration that have occurred in the United States since 1900.

24. List three characteristics of an urban place.

25. List three characteristics of a rural place.

26. List three characteristics of a suburban place.

27. List three sources of internal migrants in the United States since 1910.

28. List three areas that have received great numbers of internal migrants in the United States since 1910.

29. Describe the major trend of the individual state's population growth in the United States between 1960 and 1970.

30. Identify three areas of high population density in the United States in 1970.

Part 3

The student will be able to:

1. Describe differing rates of population growth in the United States and Mexico between 1900 and 1971.

2. Describe the major changes in the United States and Mexican birth and death rates between 1920 and 1971.

3. Identify the major cause of the rapid growth of the Mexican population since 1920.

4. Interpret information concerning age and sex distribution from a population pyramid.

5. Describe the ratio of men and women over 65 in the United States in 1970.

6. Identify the age groups that primarily constitute the working populations in the United States and Mexico.

7. Compare the proportion of the Mexican population that is under 15 years old with the proportion of the U ited States population that is under 15 years old.

8. Identify the two racial groups that composed the largest segment of the United States population in 1970.

9. Define the term "Mestizo."

10. Identify the three racial groups that composed the largest segment of the Mexican population in 1970.

11. Interpret information concerning growth rates from a population change model.

12. List the characteristics of the four stages of the population change model.

13. Identify the stage of the population change model that the United States and Mexico were in during the year 1970.

14. Provide an estimate of the United States population in the year 2000 based on median estimates of demographers.

15. Provide an estimate of the population of Mexico in the year 2000 based on Median estimates of demographers.

# APPENDIX D

# FIELD TEST FORM OF CRITERION POSTTEST

(Field Test)



FINAL TEST FOR UNIT

"POPULATION GROWTH IN THE UNITED STATES AND MEXICO"

Name _____

Grade (check one): 5( ), 6( ), 7( )

Select the answer which best completes the following sentences. Place the number of the correct answer on the line provided in the answer column.

ANSWER COLUMN

1. Before 1500 the density of Indian population in the United States was
   1. far greater than in Mexico.
   2. only slightly greater than in Mexico.
   3. about the same as in Mexico.
   4. less than in Mexico. _____

2. Most of the Indian groups that lived in southern and central Mexico in 1500 produced their food by
   1. hunting animals like deer and buffalo.
   2. gathering seeds and wild fruits.
   3. farming crops such as maize, beans, and squash.
   4. fishing for trout, salmon, and tuna. _____

3. The greatest killer of Indians in both Mexico and the United States was the
   1. bullets from the White man's guns.
   2. forcing of Indians to work in gold and silver mines.
   3. diseases brought to the New World from Europe and Africa.
   4. forcing Indians to work on plantations. _____

4. The major cause for the low rate of immigration to Mexico between 1810 and 1920 was that
   1. Mexico was involved in many foreign and civil wars during this period.
   2. Mexico was already overpopulated in 1810.
   3. diseases made Mexico very unsafe during this period.
   4. the government stopped all immigration to Mexico after 1810. _____

5. The total population of Mexico in 1971 was about
   1. 12 million.
   2. 52 million.
   3. 72 million.
   4. 102 million. _____

6. Since 1930 Mexico has gone through a period of
   1. war and rapid population growth.
   2. war and slow population growth.
   3. peace and rapid population growth.
   4. peace and slow population growth.

7. The major reason for Mexico's population growth since 1930 has been
   1. a great decrease in the birth rate.
   2. a great increase in the death rate.
   3. a great decrease in the death rate.
   4. a great increase in the number of immigrants.

8. A migrant who moves out of a country is called an
   1. internal migrant.
   2. internal emigrant.
   3. immigrant.
   4. emigrant.

9. The parts of a country where most of the people make their living by fishing, farming, and mining are called
   1. city areas.
   2. urban areas.
   3. suburban areas.
   4. rural areas.

10. Most of Mexico's major urban places are located
    1. along the shores of the Pacific Ocean.
    2. along the shores of the Gulf of Mexico.
    3. along Mexico's southern border with Guatemala.
    4. at inland sites in the central and northern part of the country.

11. As a larger part of a country's population starts to live and work in urban areas, we can expect the country's
    1. death rate to rise.
    2. birth rate to stay the same.
    3. birth rate to decline.
    4. birth rate to rise.

12. Three European countries that established colonies in North America east of the Mississippi River were
    1. England, Ireland, and Germany.
    2. England, Spain, and Mexico.
    3. England, France, and Ireland.
    4. England, Spain, and France.

13. The major reason the United States government takes a census of the population is to
    1. determine the size of the U.S. population.
    2. determine the amount of taxes each citizen must pay.
    3. decide the number of senators each state will have in the United States Senate.
    4. decide the number of representatives each state will have in the House of Representatives.

14. The birth rate, death rate, and migration rate are called population
    1. effects.
    2. causes.
    3. variables.
    4. bombs.

15. A shortage of food and a lack of jobs will
    1. pull immigrants into a country.
    2. push emigrants out of a country.
    3. push immigrants into a country.
    4. pull emigrants out of a country.

16. Before 1860 most of the immigrants that came to the United States came from the countries of
    1. England, Ireland, and Germany.
    2. Spain, France, and Italy.
    3. Hungary, Italy, and Poland.
    4. Canada and Mexico.

17. In 1965 most of the immigrants that came to the United States came from
    1. England, Ireland, and Germany.
    2. Mexico and Canada.
    3. Hungary, Italy, and Poland.
    4. England, France, and Spain.

18. The great increase of the United States birth rate after the end of World War II is called the
    1. Great Depression.
    2. Population Explosion.
    3. Baby Boom.
    4. Cold War.

19. Since 1920 the United States'
    1. death rate has declined sharply.
    2. birth rate has stayed about the same.
    3. birth rate has declined sharply.
    4. birth rate has moved down, up, and down again.

20. The most important type of United States internal migration that has occurred since 1900 has been
    1. urban to rural.
    2. cities to farms.
    3. rural to urban.
    4. suburban to urban.

21. Since 1940 many Americans have migrated from
    1. cities to suburbs.
    2. cities to farms.
    3. suburbs to cities.
    4. suburbs to farms.

22. The greatest number of Mexican Americans living in the United States today live in the
    1. southeastern part of the country.
    2. northeastern part of the country.
    3. northwestern part of the country.
    4. southwestern part of the country.

    _____

23. The 1970 census showed that
    1. all states were not growing at the same rate.
    2. all states were growing at the same rate.
    3. some states were adding large numbers to their populations and none were losing population.
    4. more states were losing population than were gaining population.

    _____

24. Since 1910 there has been a strong migration of
    1. old people from Florida to New York.
    2. Blacks from the southern cities to the northern cities.
    3. Whites from California to Nebraska and Oklahoma.
    4. Mexican Americans from Montana to New Mexico.

    _____

25. In the United States the area of highest population density runs from
    1. Chicago to Los Angeles.
    2. El Paso to Miami.
    3. Boston to Washington.
    4. Washington to Miami.

    _____

26. In 1971 the United States had a total population of about
    1. 58 million.
    2. 108 million.
    3. 208 million.
    4. 408 million.

    _____

27. In 1971 the Mexican population was
    1. growing at a slower rate than the United States population.
    2. growing at a faster rate than the United States population.
    3. growing at the same rate as the United States population.
    4. not growing at all.

    _____

28. In 1971 the average age of the United States population was
    1. older than the average age of the Mexican population.
    2. about the same as the average age of the Mexican population.
    3. younger than the average age of the Mexican population.
    4. much younger than the average age of the Mexican population.

    _____

29. About 10 out of every 100 people in the United States are
    1. Mestizos.
    2. Whites.
    3. Blacks.
    4. Mexican Americans.

    _____

30. Over 1/2 of the people in Mexico are
    1. Spanish.
    2. Mestizos.
    3. Blacks.
    4. Indians.

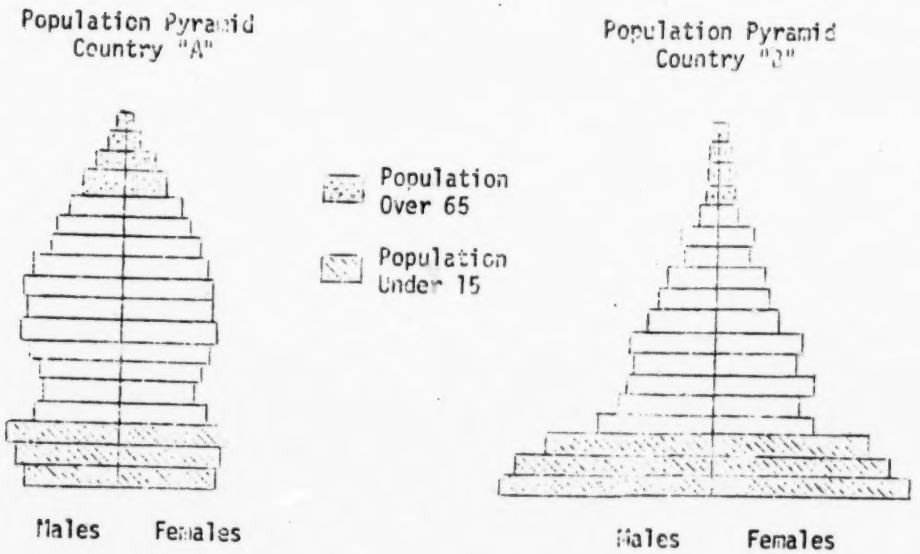
    _____

31. The introduction of modern medicine and improvements in sanitation in many of the underdeveloped nations of the world has caused a rapid
    1. increase in the birth rates.
    2. decrease in the birth rates.
    3. increase in the death rates.
    4. decrease in the death rates.

    _____

32. By the year 2000 some demographers expect the United States population to be about
    1. the same size as the Mexican population.
    2. twice as large as the Mexican population.
    3. four times as large as the Mexican population.
    4. eight times as large as the Mexican population.

    _____




33. The part of the population under 15 years old is
    1. greater in Country "A" than in Country "B".
    2. the same in Country "A" as in Country "B".
    3. the same in Country "B" as in Country "A".
    4. less in Country "A" than in Country "B".

_____

34. The birth rate in Country "B" is likely to be
    1. much lower than in Country "A".
    2. only slightly lower than in Country "A".
    3. about the same as in Country "A".
    4. much higher than in Country "A".

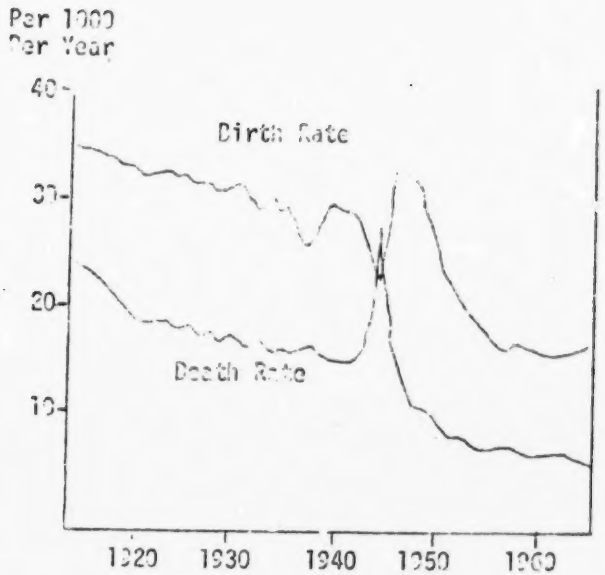
_____

35. The part of the population over 65 years old is
    1. greater in Country "A" than in Country "B".
    2. the same in Country "A" as in Country "B".
    3. the same in Country "B" as in Country "A".
    4. less in Country "A" than in Country "B".

_____

36. The government of Country "B" would have to be more concerned with
    1. building old age homes.
    2. providing hospitals for old people.
    3. building more schools.
    4. building homes for newly weds.

_____




37. Since 1920, the birth and death rate in this country has
    1. stayed the same.
    2. dropped slowly.
    3. increased slowly.
    4. increased very rapidly.

_____

38. One explanation for the change in the birth and death rate of this country between 1940 and 1950 could be
    1. a time of peace.
    2. good working conditions.
    3. war and hard times.
    4. a great flow of immigrants coming in.

_____

39. Population growth in this country would have been the greatest in
    1. 1929.
    2. 1939.
    3. 1949.
    4. 1959.

_____

40. The birth rate and death rate of this country in 1960 would be most like that of
    1. the United States in 1790.
    2. Mexico in 1810.
    3. Mexico in 1930.
    4. the United States in 1970.

_____

41. In 1971 Mexico's largest urban place was
    1. Mexico City.
    2. Tampico.
    3. Ciudad Juarez.
    4. Tijuana.

    _____

42. Some river valleys were good sites of early settlements because they
    1. were the homes of only friendly Indians.
    2. they had many valuable minerals.
    3. provided good soils and easy transportation.
    4. were free of diseases and insects.

    _____

43. Between the years 1790 and 1860 most American families had
    1. no children.
    2. about one child.
    3. about three children.
    4. five or more children.

    _____

44. The population of the United States in 1971 was
    1. smaller than the Mexican population.
    2. about the same size as the Mexican population.
    3. about twice as large as the Mexican population.
    4. about four times as large as the Mexican population. _____

45. The United States Constitution states that a census of the population must be taken every
    1. year.
    2. 5 years.
    3. 10 years.
    4. 20 years.

    _____

46. The number of women over 65 years old in the United States is
    1. less than the number of men over 65.
    2. about the same as the number of men over 65.
    3. far less than the number of men over 65.
    4. greater than the number of men over 65.

    _____

47. Many of the countries that are taking their first steps toward modernization have high birth rates and low death rates. This means that they will likely have
    1. high growth rates.
    2. low growth rates.
    3. growth rates that are slowing down.
    4. little or no growth.

    _____

48. A country with a large part of its population under 15 years old is likely to have a
    1. high growth rate.
    2. high death rate.
    3. low birth rate.
    4. low growth rate.

    _____

49. Many of the more modern nations of the world, like Sweden, Japan, and the United States, have
    1. low birth rates and low death rates.
    2. low birth rates and high death rates.
    3. high birth rates and low death rates.
    4. high birth rates and high death rates.

    _____

50. A map of population density shows the
    1. total population of a country.
    2. number of people living in each state.
    3. average number of people for each square mile.
    4. number of square miles in a country.

    _____

# APPENDIX E

## PILOT FORM OF CRITERION POSTTEST

Name.....

(Pilot Test)
UNIT TEST

Select the answer which best completes the following sentences. Place the letter of the correct answer on the line provided.

_____ 1. Before 1500 the density of Indian population in the United States was
A. far greater than in Mexico.
B. only slightly greater than in Mexico.
C. about the same as in Mexico.
D. less than in Mexico.

_____ 2. Most of the Indian groups that lived in southern and central Mexico in 1500 produced their food by
A. hunting animals like deer and buffalo.
B. gathering seeds and wild fruits.
C. farming crops such as maize, beans, and squash.
D. fishing for trout, salmon, and tuna.

_____ 3. In Mexico the marrying of Indian women to Spanish men has produced people of a mixed racial group. These people are called
A. Europeans.
B. Mestizos.
C. Indians.
D. Mexican Americans.

_____ 4. The greatest killer of Indians in both Mexico and the United States was the
A. bullets from the White man's guns.
B. forcing of Indians to work in gold and silver mines.
C. diseases brought to the New World from Europe and Africa.
D. forcing Indians to work on plantations.

_____ 5. The major cause for the low rate of immigration to Mexico between 1810 and 1920 was that
A. Mexico was involved in many foreign and civil wars during this period.
B. Mexico was already overpopulated in 1810.
C. diseases made Mexico very unsafe during this period.
D. the government stopped all immigration to Mexico after 1810.

_____ 6. The total population of Mexico in 1971 was about
A. 12 million.
B. 52 million.
C. 102 million.
D. 302 million.

_____ 7. Since 1930 Mexico has gone through a period of
A. many civil and foreign wars.
B. great food shortages.
C. peace and rapid population growth.
D. peace and slow population growth.

_____ 8. In the countries of the world today a death rate of 9 per 1000 would be considered
A. very low.
B. about average.
C. high.
D. very high.

_____ 9. The major reason for Mexico's population growth since 1930 has been
A. a great increase in the birth rate.
B. a great increase in the death rate.
C. a great decrease in the death rate.
D. a great increase in the number of immigrants coming into Mexico.

_____10. The difference between a vacation trip and a migration is that
A. a vacation trip is a permanent move.
B. a migration is a permanent move.
C. a migration is a long distance move and a vacation trip is a short distance move.
D. a vacation trip is a long distance move and a migration is a short distance move.

_____11. A migrant who moves out of a country is called an
A. internal migrant.
B. internal emigrant.
C. immigrant.
D. emigrant.

_____12. In 1971 Mexico's largest urban place was
A. Mexico City.
B. Tampico.
C. Ciudad Juarez.
D. Tijuana.

_____13. Tijuana, Ciudad Juarez, and Mexicali are cities located along Mexico's border with
A. Guatemala.
B. the United States.
C. Canada.
D. Honduras.

_____14. The parts of a country where most of the people make their living by fishing, farming, and mining are called
A. city areas.
B. urban areas.
C. suburban areas.
D. rural areas.

_____15. Most of Mexico's major urban places are located
A. along the shores of the Pacific Ocean.
B. along the shores of the Gulf of Mexico.
C. along Mexico's southern border with Guatemala.
D. at inland sites in the central and northern part of the country.

_____16. As a larger part of a country's population starts to live and work in urban areas, we can expect the country's
A. death rate to rise.
B. birth rate to stay the same.
C. birth rate to decline.
D. birth rate to rise.

_____17. Three European countries that established colonies in North America east of the Mississippi River were
A. England, Ireland, and Germany.
B. England, Spain, and Mexico.
C. Canada, Spain, and France.
D. England, Spain, and France.

_____18. Some river valleys were good sites of early settlements because they
A. were the homes of only friendly Indians.
B. they had many valuable minerals.
C. provided good soils and easy transportation.
D. were free of diseases and insects.

_____19. The United States Constitution states that a census of the population must be taken every
A. 10 years.
B. 20 years.
C. year.
D. 100 years.

_____20. Most of the Black slaves that were brought to the British colonies in the New World were used to
A. work in the mills of New England.
B. work on large plantations in the Southern Colonies.
C. work as hunters and trappers.
D. work on farms of the Middle Colonies.

_____21. The major reason the United States government takes a census of the population is to decide
A. who the next President will be.
B. who the next Vice-President will be.
C. the number of senators each state will have in the United States Senate.
D. the number of representatives each state will have in the House of Representatives.

_____22. Much of the southwestern part of the United States once belonged to
A. England.
B. Mexico.
C. France.
D. Canada.

_____23. The birth rate, death rate, and migration rate are called populat:
A. factors.
B. causes.
C. variables.
D. bombs.

_____24. Between the years 1790 and 1860 most American families had
A. very few children.
B. no children.
C. about 3 children.
D. 5 or more children.

_____25. A shortage of food and a lack of jobs will
A. pull immigrants into a country.
B. push emigrants out of a country.
C. push immigrants into a country.
D. pull emigrants out of a country.

_____26. Before 1860 most of the immigrants that came to the United States came from the countries of
A. England, Ireland, and Germany.
B. England, Spain, and France.
C. Hungary, Italy, and Poland.
D. Canada and Mexico.

_____27. In 1965 most of the immigrants that came to the United States came from
A. England, Ireland, and Germany.
B. Mexico and Canada.
C. Hungary, Italy, and Poland.
D. England, France, and Spain.

_____28. The great increase of the United States birth rate after the end of World War II is called the
A. Great Depression.
B. Population Explosion.
C. Baby Boom.
D. Cold War.

_____29. Since 1920 the United States
A. death rate has declined sharply.
B. birth rate has stayed about the same.
C. birth rate has declined sharply.
D. birth rate has moved down, up, and down again.

_____30. The most important type of United States internal migration that has occurred since 1900 has been
A. urban to rural.
B. cities to farms.
C. rural to urban.
D. rural to rural.

_____31. Since 1940 many Americans have migrated from
A. cities to suburbs.
B. cities to farms.
C. suburbs to cities.
D. suburbs to farms.

_____32. The greatest number of Mexican Americans living in the United States today live in the
A. central part of the country.
B. northeastern part of the country.
C. northwestern part of the country.
D. southwestern part of the country.

_____33. The number of Mexican Americans in the United States today is
A. declining slowly.
B. declining rapidly.
C. increasing.
D. staying about the same.

_____34. The 1970 census showed that
A. all states were not growing at the same rate.
B. all states were growing at the same rate.
C. some states were adding large numbers to their populations and none were losing population.
D. more states were losing population than were gaining population.

_____35. Since 1910 there has been a strong migration of
A. old people from Florida to Indiana.
B. Blacks from the southern cities to the northern cities.
C. Whites from California to Nebraska and Oklahoma.
D. Mexican Americans from Montana to New Mexico.

_____36. In the United States there is a continuous strip of land with a high density of population that runs from
A. New York to Los Angeles.
B. El Paso to Chicago.
C. Boston to Washington.
D. Miami to New York.

_____37. In 1971 the United States had a total population of about
A. 58 million.
B. 108 million.
C. 208 million.
D. 408 million.

_____38. The population of the United States in 1971 was
A. about the same size as the Mexican population.
B. smaller than the Mexican population.
C. about twice as large as Mexico's population.
D. about four times as large as Mexico's population.

_____39. In 1971 the Mexican population was
A. growing at a slower rate than the United States population.
B. growing at a faster rate than the United States population.
C. growing at the same rate as the United States population.
D. not growing at all.

_____40. In 1971 the average age of the United States population was
A. older than the average age of the Mexican population.
B. about the same as the average age of the Mexican population.
C. younger than the average age of the Mexican population.
D. much younger than the average age of the Mexican population.

_____41. The number of women over 65 years old in the United States is
A. less than the number of men over 65.
B. about the same as the number of men over 65.
C. far less than the number of men over 65.
D. greater than the number of men over 65.

_____42. The work force of a country's population is made up largely of people between the ages of
A. 45 and 65.
B. 15 and 65.
C. 15 and 45.
D. 15 and 35.

_____43. Countries that have older populations are likely to spend more money for
A. schools and education.
B. parks and play grounds.
C. retirement funds and old age homes.
D. churches and kindergartens.

_____44. A country with a large part of its population under 15 years old is likely to have
A. a high growth rate.
B. a high death rate.
C. a low birth rate.
D. no growth rate.

_____45. About 10 out of every 100 people in the United States are
A. Mestizos.
B. Whites.
C. Blacks.
D. Mexican Americans.

_____46. Over 1/2 of the people in Mexico are
A. Spanish.
B. Mestizos.
C. Blacks.
D. Indians.

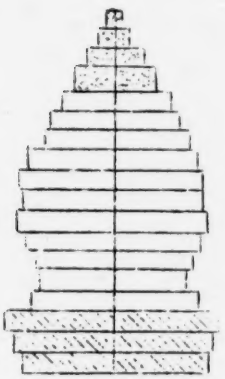
_____47. The introduction of modern medicine and improvements in sanitation in many of the underdeveloped nations of the world has caused a
A. rapid increase in the birth rates.
B. rapid decrease in the birth rates.
C. rapid increase in the death rates.
D. rapid decrease in the death rates.

_____48. Many of the countries that are taking their first steps toward modernization have high birth rates and low death rates. This means that they will likely have
A. high growth rates.
B. low growth rates.
C. growth rates that are slowing down.
D. little or no growth.

_____49. Many of the more modern nations of the world, like Sweden, Japan, and the United States, have
A. low birth rates and low death rates.
B. low birth rates and high death rates.
C. high birth rates and low death rates.
D. high birth rates and high death rates.

_____50. By the year 2000 some demographers expect the United States population to be
A. smaller than the Mexican population.
B. about twice as large as the Mexican population.
C. about four times as large as the Mexican population.
D. about the same size as the Mexican population.

Population Pyramid
Country "A"

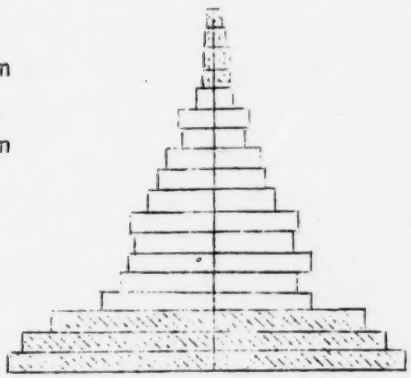


Males Females

Population Over 65

Population Under 15

Population Pyramid
Country "B"



Males Females

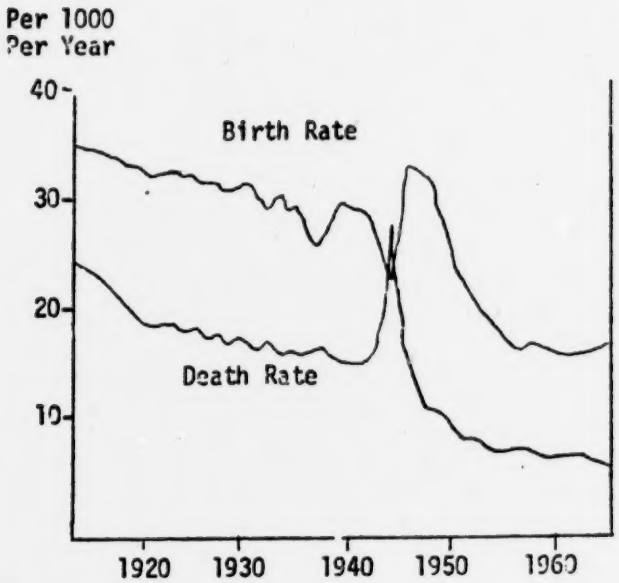
_____1. These two pyramids show the distribution of two population traits. They are
A. height and weight.
B. sex and weight.
C. age and weight.
D. sex and age.

_____2. The part of the population under 15 years old is
A. greater in Country "A" than in Country "B".
B. the same in Country "A" as in Country "B".
C. the same in Country "B" as in Country "A".
D. less in Country "A" than in Country "B".

_____3. The birth rate in Country "B" is likely to be
A. much lower than in Country "A".
B. only slightly lower than in Country "A".
C. about the same as in Country "A".
D. much higher than in Country "A".

_____4. The shape of Country's "A" pyramid would be most like that of
A. the United States in 1790.
B. Mexico in 1810.
C. the United States in 1970.
D. Mexico in 1970.

_____5. The government of Country "B" would have to be more concerned with
A. building old age homes.
B. providing hospitals for old people.
C. building more schools.
D. building homes for newly weds.




_____6. Since 1920, the birth and death rate in this country has
A. stayed the same.
B. dropped slowly.
C. increased slowly.
D. increased very rapidly.

_____7. One explanation for the change in the birth and death rate of this country between 1940 and 1950 could be
A. a time of peace.
B. good working conditions.
C. war and hard times.
D. a great flow of immigrants coming in.

_____8. Population growth in this country would have been the greatest in
A. 1929
B. 1939.
C. 1949.
D. 1959.

_____9. The birth rate and death rate of this country in 1960 would be most like that of
A. the United States in 1790.
B. Mexico in 1810.
C. Mexico in 1970.
D. the United States in 1970.

# APPENDIX F

## TABLE OF SPECIFICATIONS FOR CRITERION POSTTEST FOR THE UNIT POPULATION GROWTH IN THE UNITED STATES AND MEXICO

TABLE OF SPECIFICATIONS FOR CRITERION POSTTEST

| Content Dimension | Recall | | Comprehension | | Application | | Analysis | | Total Content Dimension |
|---|---|---|---|---|---|---|---|---|---|
| | Question Number | Percentage of Total | Question Number | Percentage of Total | Question Number | Percentage of Total | Question Number | Percentage of Total | |
| PART 1 Mexicans | | | | | | | | | 22% |
| Indians | | | 1, 2 | (4%) | | | | | |
| Growth | 5 | (2%) | | | 6, 7, 11 | (6%) | | | |
| Migration | 8 | (2%) | | | | | 4 | (2%) | |
| Urbanization | 9 | (2%) | 10, 41 | (4%) | | | | | |
| PART 2 United States | | | | | | | | | 36% |
| Indians | | | 3 | (2%) | | | | | |
| Colonial Period | 12 | (2%) | 43 | (2%) | 42 | (2%) | | | |
| Census | 45 | (2%) | 13 | (2%) | | | | | |
| Growth Rates | 26, 18 | (4%) | 19 | (2%) | | | 23, 44 | (4%) | |
| Internal Migration | | | 20 | (2%) | | | 24 | (2%) | |
| International Migration | | | 16, 17, 21 | (6%) | | | | | |
| Mexican Americans | | | 22 | (2%) | | | | | |
| Density | | | 25 | (2%) | | | | | |
| PART 3 Comparison | | | | | | | | | 24% |
| Projections | | | | | 32, 49 | (4%) | | | |
| Growth | 14 | (2%) | 15 | (2%) | | | 27, 47 | (4%) | |
| Composition | | | 29, 46, 30 | (6%) | | | 28, 48 | (4%) | |
| Population Change Model | | | | | 31 | (2%) | | | |
| PART 4 Graphics | 50 | (2%) | 33, 35, 37 | (6%) | 38, 40 | (4%) | 36, 34, 39 | (6%) | 18% |
| TOTAL BEHAVIORAL DIMENSION | | (18%) | | (42%) | | (18%) | | (22%) | 100% |

# APPENDIX G

## PILOT TEST DIFFICULTY AND DISCRIMINATION INDICES

PILOT TEST DIFFICULTY AND DISCRIMINATION INDICES

| Question | Difficulty Index | Discrimination Index | Question | Difficulty Index | Discrimination Index |
|---|---|---|---|---|---|
| 1 | .46 | .50 | 31 | .39 | .43 |
| 2 | .44 | .43 | 32[b] | .55 | .46 |
| 3[a] | .94 | .11 | 33[a] | .29 | .18 |
| 4 | .82 | .18 | 34 | .57 | .54 |
| 5 | .64 | .46 | 35 | .57 | .32 |
| 6[b] | .62 | .32 | 36[b] | .18 | .04 |
| 7[b] | .51 | .50 | 37 | .49 | .29 |
| 8[a] | .46 | .04 | 38[b] | .27 | .57 |
| 9[b] | .28 | .29 | 39 | .35 | .21 |
| 10[a] | .74 | .36 | 40 | .38 | .39 |
| 11 | .51 | .39 | 41 | .39 | .25 |
| 12 | .72 | .64 | 42[a] | .31 | .21 |
| 13[a] | .75 | .21 | 43[a] | .67 | .43 |
| 14 | .68 | .61 | 44[b] | .54 | .18 |
| 15 | .40 | .68 | 45 | .42 | .57 |
| 16 | .33 | .57 | 46 | .60 | .39 |
| 17[b] | .59 | .46 | 47 | .59 | .75 |
| 18 | .72 | .36 | 48 | .67 | .57 |
| 19[b] | .78 | .50 | 49 | .29 | .29 |
| 20[a] | .82 | .46 | 50[b] | .28 | .14 |
| 21[b] | .75 | .11 | 51[a] | .78 | .36 |
| 22[a] | .72 | .32 | 52 | .73 | .57 |
| 23[b] | .55 | .36 | 53 | .51 | .32 |
| 24[b] | .51 | .18 | 54[c] | .29 | .14 |
| 25 | .57 | .43 | 55 | .58 | .32 |
| 26[b] | .29 | .14 | 56 | .64 | .46 |
| 27 | .41 | .32 | 57 | .28 | .07 |
| 28 | .40 | .46 | 58 | .61 | .39 |
| 29 | .40 | .25 | 59[b] | .32 | .14 |
| 30[b] | .57 | .50 | | | |

a - Questions that were dropped.
b - Questions that were modified.
c - New questions that were substituted.

# APPENDIX H

# POPULATION GROWTH IN THE UNITED STATES AND MEXICO: FIRM TREATMENT

# APPENDIX I

# POPULATION GROWTH IN THE UNITED STATES AND MEXICO: NARRATIVE TREATMENT

# APPENDIX J

# BIBLIOGRAPHY OF SOURCES FOR CONSTRUCTION OF POPULATION-GEOGRAPHY CURRICULUM MATERIALS

# BIBLIOGRAPHY OF SOURCES FOR CONSTRUCTION OF POPULATION-GEOGRAPHY CURRICULUM MATERIALS

| Chapter | Set | Source |
|---|---|---|
| 1 | 1 | Driver, H. F. Indians of North America. Chicago: University of Chicago Press, 1961. |
| | | Cook, S. F. & Borah, W. Conquest and population: a demographic approach to Mexican history. Proceedings of the American Phiosophical Society, 1969, 113, 177-183. |
| 1 | 2 | Driver, H. F. Ibid. |
| | | Vlahos, Olivia. New world beginnings, Indian cultures in the Americas. New York: Viking Press, 1970. |
| 1 | 3 | West, R. C. & Augelli, J. P. Middle America its land and people. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1966. |
| 1 | 4 | Driver, H. F. Ibid. |
| 1 | 5 | West, R. C. & Augelli, J. P. Ibid. |
| 1 | 6 | Lindop, E. Understanding Latin America. Boston: Ginn & Company, 1960. |
| | | McWilliams, C. North from Mexico. Philadelphia: J. B. Lippincott Company, 1968. |
| 1 | 7 | Population Bulletin, 1964, 20 (7). |
| 1 | 8 | Trewartha, G. T. A geography of population: World patterns. New York: John Wiley & Son, Inc. 1969. |
| 1 | 9 | Population Bulletin, 1964, 20 (7). |
| 1 | 10 | Zelinsky, W. A prologue to population geography. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1966. |
| 1 | 11 | Peterson, W. Population. New York: The MacMillan Company, 1961. |

1 11 James, P. E. Latin America. New York: The Odyssey Press, 1959.

1 12 Peterson, W. Ibid.

1 13 Trewartha, G. T. Ibid.

1 14 United Nations. Demographic yearbook, 1970. New York: UN Publication, 22nd issue, 1971.

1 15 Revista De Estadistica, Secretaria De Industria Y Commercio Direcction General De Estidistica ABRIL, 1971, Mexico.

West, R. C. & Augelli, J. P. Ibid.

1 16 Population Bulletin, 1964, 20 (7).

Revista De Estadistica. Ibid.

Africa, the Americas, Asia, Australasia. London: Europa Publications, Ltd., 1971.

2 1 Mooney, J. The aboriginal population of America north of Mexico. Washington, D.C.: Smithsonian Institute, Smithsonian Miscellaneous Collection, 1928, 80 (7).

Hadley, J. N. The demography of the American Indian. Annals of the American Academy of Political and Social Science, 1957, 311, 23-30.

2 2 Friis, H. R. A series of population maps of the colonies and the United States, 1625-1790. The Geographical Review, 1940, 30.

2 3 Friis, H. R. Ibid.

2 4 Green, E. B. & Harrington, V. D. American population before the federal census of 1790. New York: Columbia University Press, 1932.

Bogue, D. J. The population of the United States. Glencoe, Illinois: The Free Press of Glencoe, Illinois, 1959.

Franklin, J. H. From slavery to freedom: A history of negro Americans. New York: Alfred A. Knopf, Inc., 1967.

2 5 Greene, E. B. & Harrington, V. D. Ibid.

2 5 Katz, W. L. (Ed.) Negro population in the US 1790-1915. New York: Arno Press, Inc., & New York Times, 1968.

2 6 Peterson, W. Ibid.

U.S. Department of Commerce, Bureau of the Census. 1960 census of population. Washington, D.C.: Author, 1960.

2 7 Ver Steeg, C. L. The story of our country. Evanston, Illinois: Harper and Row Publishers, 1965.

2 8 Peterson, W. Ibid.

Schoolcraft, H. R. Historical and statistical information respecting the history, condition and prospects of the Indian tribes of the United States. Lippincott, Grambo and Company, 1851.

2 9 Taeuber, C. & Taeuber, I. B. The changing population of the United States. New York: John Wiley & Son, Inc. 1958.

2 10 Broek, J. O. M. & Webb, W. J. A geography of mankind. New York: McGraw-Hill Book Company, 1968.

Taeuber, C. & Taeuber, I. B. Ibid.

2 11 Taeuber, C. & Taeuber, I. B. Ibid.

2 12 Bogue, D. J. Ibid.

2 13 Bogue, D. J. Ibid.

2 14 Bogue, D. J. Ibid.

The future population of the United States. Population Bulletin, 1971, 27 (1), 7.

2 15 Taeuber, C. & Taeuber, I. B. Ibid.

2 16 Bogue, D. J. Ibid.

U.S. Bureau of the Census. The statistical history of the United States from colonial times to the present. Stamford, Connecticut: Fairfield Publishers, Inc., 1965.

2 17 U.S. Department of Commerce, Bureau of the Census. Selected characteristics of persons and families of Mexican, Puerto Rican and other Spanish Origins. Serial P-20, No. 224, October, 1971.

McWilliams, C. Ibid.

Moore, J. W. Mexican Americans. Englewood Cliffs, New Jersey: Prentice-Hall, Inc. 1970.

2 18 Murphy, R. E. The American city: An urban geography. New York: McGraw-Hill Book Company, 1966.

2 19 Where will the next 50 million Americans live. Population Bulletin, 1971, 25 (5), p. 9.

U.S. Department of Commerce, Bureau of the Census. 1970 census of population, number of inhabitants. PC(1)-A1, 1971, p. 62.

2 20 Thornthwaite, C. W. Internal migration in the U.S. Philadelphia: University of Pennsylvania Press, 1934.

Broeke, J. O. M. & Webb, W. J. Ibid.

U.S. Department of Commerce, Bureau of the Census. 1970 census of population, number of inhabitants. PC(1)-A1, 1971, p. 23.

2 21 Life pictorial atlas of the world. New York: Time, Inc., 1961.

Espenshade, E. B., Jr. (Ed.) Goodes world atlas. Chicago: Rand McNally & Company, 1971.

Williams, J. E. (Ed.) World atlas. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1963.

3 1 The future population of the United States. Population Bulletin, 1971, 27 (1), p. 7.

Cline, H. F. Mexico: Revolution to evolution, 1940-1960. London: Oxford University, 1962.

Population Reference Bureau. 1971 world population data sheet. Author, 1971.

3 2 Cline, H. F. Ibid.

3 2 The future population of the United States. Population Bulletin, 1971, 27 (1), 9.

3 3 Population Bulletin, 1964, 20 (7).

Broeke, J. O. M. & Webb, W. J. Ibid.

3 4 U.S. Department of Commerce, Bureau of the Census. Selected characteristics of persons and families of Mexican, Puerto Rican and other Spanish Origins. Serial P-20, No. 224, October, 1971.

3 5 Broeke, J. O. M. & Webb, W. J. Ibid.

Trewartha, G. T. Ibid.

3 6 Where will the next 50 million Americans live. Population Bulletin, 1971, 25 (5), p. 9.

Population Bulletin, 1964, 20 (7).

Revista De Estadistica. Ibid.